THE NATIONAL SHIPBUILDING RESEARCH PROGRAM

CONSUMABLE GUIDE ELECTROSLAG WELDING OF 4 TO 24 INCH THICK CARBON STEEL CASTINGS

U.S. DEPARTMENT OF TRANSPORTATION
MARITIME ADMINISTRATION

IN COOPERATION WITH
NEWPORT NEWS SHIPBUILDING

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
AUG 1986	**N/A**	-

4. TITLE AND SUBTITLE
Consumable Guide Electroslag Welding of 4 to 24 Inch Thick Carbon Steel Castings

5a. CONTRACT NUMBER
5b. GRANT NUMBER
5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

5d. PROJECT NUMBER
5e. TASK NUMBER
5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Naval Surface Warfare Center CD Code 2230 - Design Integration Tools Building 192 Room 128 9500 MacArthur Blvd Bethesda, MD 20817-5700

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**SAR**	**168**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

FINAL REPORT

CONSUMABLE GUIDE ELECTROSLAG WELDING OF 4 TO 24 INCH THICK CARBON STEEL CASTINGS

AUGUST 1986

BY:

NEWFORT NEWS SHIPBUILDING
4101 WASHINGTON AVENUE
NEWPORT NEWS, VA 23607

UNDER:

MarAd Contract No. MA-80-SAC-01041

Author:

Phillip D. Thomas

TABLE OF CONTENTS

List of Figures

Foreword

The purpose of this report is to present the results of a research and development project which was initiated by the members of the Ship Production committee of the Society of Naval Architects and Marine Engineers (SNAME) and financed largely by the U. S. Maritime Administration, the U. S. Navy, and Newport News Shipbuilding (NNS). The focus of this project was directed to the development, testing and qualification of consumable guide Electroslag Welding of carbon steel castings from 4 to 24 inches in thickness.

Mr. B. C. Howse of NNS was the Chairman of the SP-7 Panel and Mr. M. I. Tanner also of NNS, was the SP-7 Program Manager. Mr. R. W. Heid, NNS, was the Project Manager, and Messrs. L. A. Craig and P. D. Thomas of NNS were the Principal Investigators.

Special acknowledgement is extended to the members of SP-7 Welding Panel of the SNAME Ship Production Committee who served as technical advisors in the preparation of inquiries and evaluation of subcontract proposals, and to Mr. M. I. Tanner for making possible the report compilation.

SUMMARY

This paper presents the results of an SP-7 Welding Panel research and development project recently completed by Newport News Shipbuilding. The focus of this project was directed toward the development, testing and qualification of consumable guide Electroslag Welding of carbon steel castings from 4 to 24 inches in thickness.

Consumable guide Electroslag Welding is a high deposition rate welding process that is ideally suited for use on thick members. This process has increased resistance to hot cracking, porosity, and underhead cracking, and results in minimal angular distortion. Joint preparation and fitup requirements are simplified and result in high quality weld deposits.

The project consisted of cast carbon steel (MIL-S-15083 Grade B) weldments ranging from 4 to 24 inches thick. Nondestructive testing included magnetic particle and radiographic inspection. Destructive testing included tensiles, Charpy V-notch impacts, and side bends. It is concluded that the use of consumable quide Electroslag Welding is an efficient process for joining thick carbon steel castings when postweld heat treatment can be used to achieve acceptable mechanical properties. Deposition rates of up to 85 lbs/hr can be achieved.

Purpose

The purpose of this study was to develop techniques, test, and qualify the multiple consumable guide electroslag welding process for joining 4 to 24 inch thick carbon steel castings.

Background

cast steel hull components have always presented unique problems for welding fabrication and repair. With conventional multi-pass welding processes the requirements for joint configuration and preparation, preheating and interpass temperature control methods, weld sequencing for distortion control, and in-process dimensional checks become fabrication bottlenecks.

The multiple consumable guide electroslag welding (ESW) process provides an alternative to these problems. The American Welding Society (AWS) in AWS A3.0 "Welding Terms and Definitions" defines electroslag welding as:

> A welding process producing coalescence of metals with molten slag which melts the filler metal and the surfaces of the work to be welded. The molten weld pool is shielded by this slag which moves along the full cross-section of the joint as welding progresses. The process is initiated by an arc which heats the slag. The arc is then extinguished and the conductive slag is maintained in a molten condition by its resistance to electric current passing between the electrode and the work.

AWS defines a variation of ESW, consumable guide electroslag welding (ESW-CG) as:

> A method of electroslag welding in which filler metal is supplied by an electrode and its guiding member.

Initially, electroslag welding was patented in the United States in 1938 (and later in 1940) as the "Hopkins Process" after its inventor, R. J. Hopkins. The process and equipment were actually developed by the Russians; most notably B. E. Paton, at the Paton Institute in Kiev, Ukraine, USSR. Their work began around 1951 and the ESW process was unveiled at the Brussels, Belgium World Fair in 1958.

The advantages of using ESW include:

- high deposition rates
- 100% operating efficiency
- high quality weld deposits
- increased resistance to hot cracking, porosity, and underbead cracking.
- minimal joint preparation and fitup requirements
- minimal angular distortion

Its disadvantages include a microstructure with extremely large grain sizes, low toughness without post weld heat treatment (PWHT), susceptibility to shrinkage or solidification cracking in the absence of an adequate run-off and relatively high operator skill level.

Even though the shipbuilding industry has used this process, very little work has been done in the U.S. on welding thick members. Newport News Shipbuilding has used electroslag welding since 1971. During construction of Liquified Natural Gas (LNG) tankers and Ultra Large Crude Carriers (ULCC), both the “plate crawler” and single electrode consumable guide versions of the process were used extensively. The plate crawler ESW method, as shown in figure 1, was used for vertical butt welds in side shell and bulkhead plating. The single electrode ESW-CG method, as shown in figure 2, was used primarily to weld butt joints in transverse frames. Multiple electrode ESW-CG, as shown in figure 3, can be used for joining shaft strut arms, rudder stocks and other thick castings. In many cases, it has not been feasible to cast these items in one piece because of their size. The ESW-CG process can significantly reduce the cost of welding these items.

PLATE CRAWLER

200
t Communicatio to
ll International, c. i
ler Company 45
gh University ⁵/8″ t0 11/2″
ev Owens Ford

+ +3/″ T ′

PARAMETERS

AMPERAGE (A)		VOLTAGE (v)	TRAVEL (1PM)	DEPOSITION (lb/hr)
325-600	c	32 to 45	1.5 to 4.5	Approx. 50

MECHANICAL PROPERTIES ABS GRADE CS

TENSILE (PSI)	CHARPY "V" (ftlbs at +14°F)	BEND (2T)
65,000 to 83,000	WELD 48-54 F.L. 37-68 HAZ 41-145 BM111 -162	SATISFACTORY

Figure 1
Plate Crawler Electroslag Welding

SEE WELDING DATA	SHEET MG85-1		

DESTRUCTIVE TESTING

PARAMETERS	AMPERAGE (A)	VOLTAGE (v)	DEPOSITION (lb/hr)
	275-560	30-39	Approx. 18

MECHANICAL PROPERTIES ABS GRADE C (NORM)

TENSILE (PSI)	CHARPY "V" (ftlbs at 32°F)	BEND (2T)
68,000 to 71,000	WELD 28 - 39	SATISFACTORY

ABS GRADE AH-36

TENSILE (PSI)	CHARPY "V" (ftlbs at +32°F)	BEND (2T)
76,000	WELD 35 F.L. 55 HAZ 34 to 71	SATISFACTORY

Figure 2
Single-Wire Consumable Guide Electroslag Welding

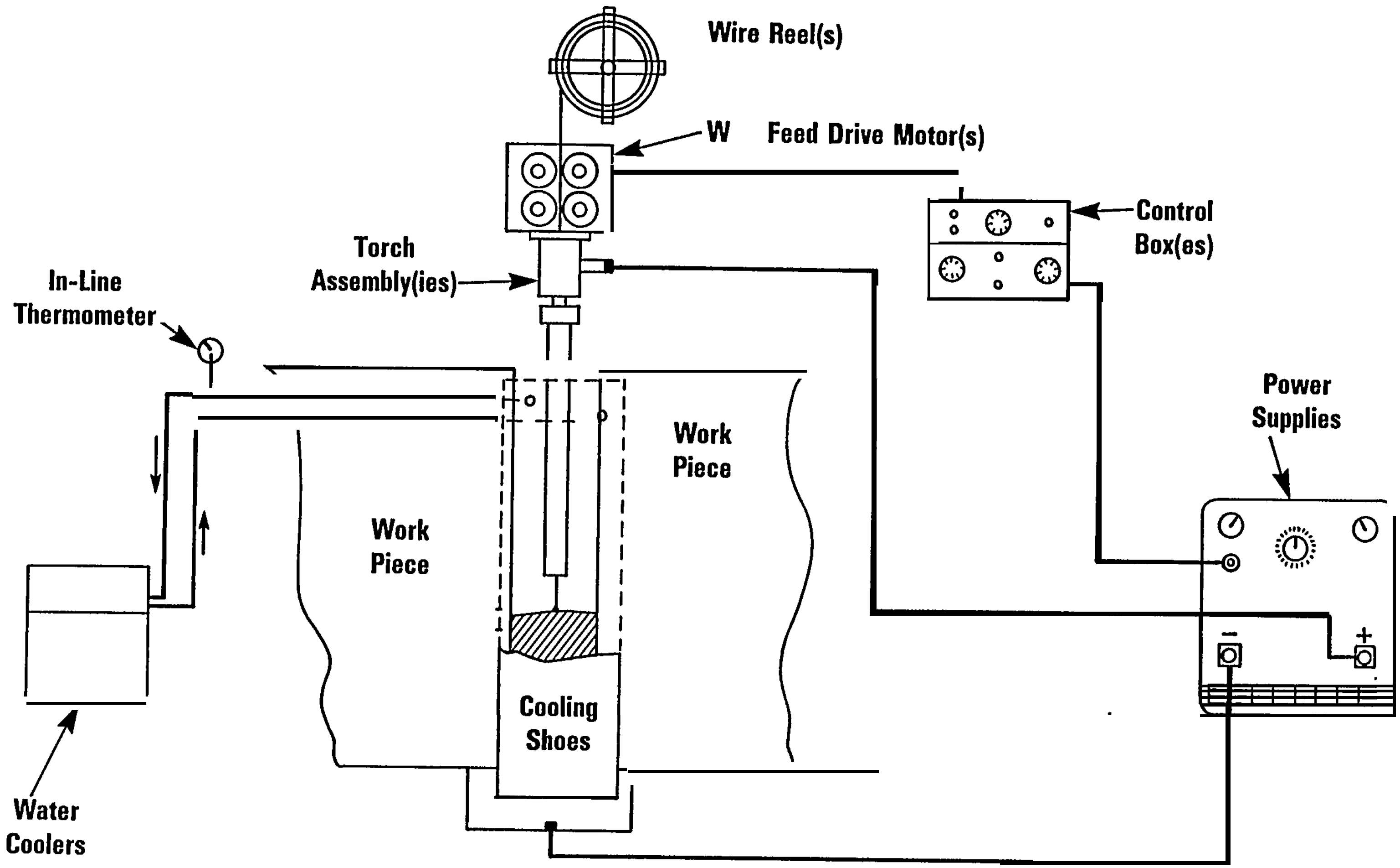


Figure 3
Block Diagram - Multiple Consumable Guide Electroslag Welding

Task

The original proposal for this project is presented in Appendix A. The task was divided into two distinct phases:

PHASE I

(a) Research of present information available on ESW techniques.
(b) Weld carbon steel castings in progressive thicknesses from 4" through 10".
(c) Weld mockup of a shaft strut arm
(d) Write Phase I report

PHASE II

(a) Weld castings from 10" through 24" using information from Phase I.
(b) Weld mockup of a rudder stock
(c) Write final report

Some of these objectives were redefined after the study began. The Phase I report was dropped in favor of further development work for production use on shaft struts. The rudder stock mocku-.was not specifically performed, but the ability to weld the larger thicknesses (16"+) covers the range needed for these stocks. An investigation into starting technique was added to Phase II. The corrected task is shown below:

PHASE I

(a) Research present information available on ESW techniques.
(b) Weld carbon steel castings in progressive thicknesses from 4" through 11".
(c) Development work for use of ESW for welding 11" thick shaft struts, including a mockup.

PHASE II

(a) Weld carbon steel castings in progressive thicknesses from 11" through 24".

(b) Compare Hobart PS-588 vs. Hobart H-25P ESW wires in the as-welded condition.

(c) Compare starting flux vs. running flux in the stress-relieved condition.

(d) Investigate starting techniques for larger guide tube spacings.

(e) Write final report to include assembly, fitup, welding, stress-relief, and NDT details

Plan

The plan to accomplish the above task is shown below:

PHASE I

(a) Research present information: Develop a bibliography during 'the course of the project; also, run the DIALOG "Weldasearch" program and provide that information.

(b) Weld castings from 4" through 11" thick: Use 4", 6", 8", and 11" thick castings to establish techniques.

(c) Procedure development of shaft strut welds: Use 11" techniques and weld a 50" long mockup. Also, weld three consecutive radiographically (RT) acceptable 11" thick joints to prove technique consistency.

PHASE II

(a) Weld castings from 11″ through 24″: Use 13″, 16″, 19″ 22″ and 24″ thick castings to establish techniques.

(b) Compare PS-588 and H-25P electrodes: Weld 24″ castings under the same conditions - one with each type of wire. Use destructive testing for comparison.

(c) Compare starting flux vs. running flux: Weld and stress-relieve 8″ castings under the same conditions - one with each type of flux. Use Charpy V-notch curves for comparison.

(d) Investigate starting techniques: Use special "starting butts″ that allow puddle visibility. Try different fluxes for starting. Use a specially designed guide tube rack to record simultaneous amperages in each guide tube below the bussed connection.

(e) Write final report.

3 Equipment

During this project, the HOBART "Porta-Slag" multiwire system was used. Figure 4 shows the equipment configuration used for the shaft strut mockup welding and is comparable to nearly all ESW welding done during this project. Figure 5 shows the HOBART RC-1000 power supplies used for all welding. All power and ground lines were composed of doubled 4/0 cables to withstand the high amperages and duty cycles. Specific equipment used for welding with up to 4 wires is listed below:

- Hobart RC-1OOO Constant Voltage Power Supplies
- Hobart Multiwire Control Panel
  - 1 - oscillator box
  - 1 - dual control tray
  - 2 - single control trays
- Hobart Multiwire Oscillating Unit ES-5
- Gilliland Large Capacity Water Coolers with flow regulation

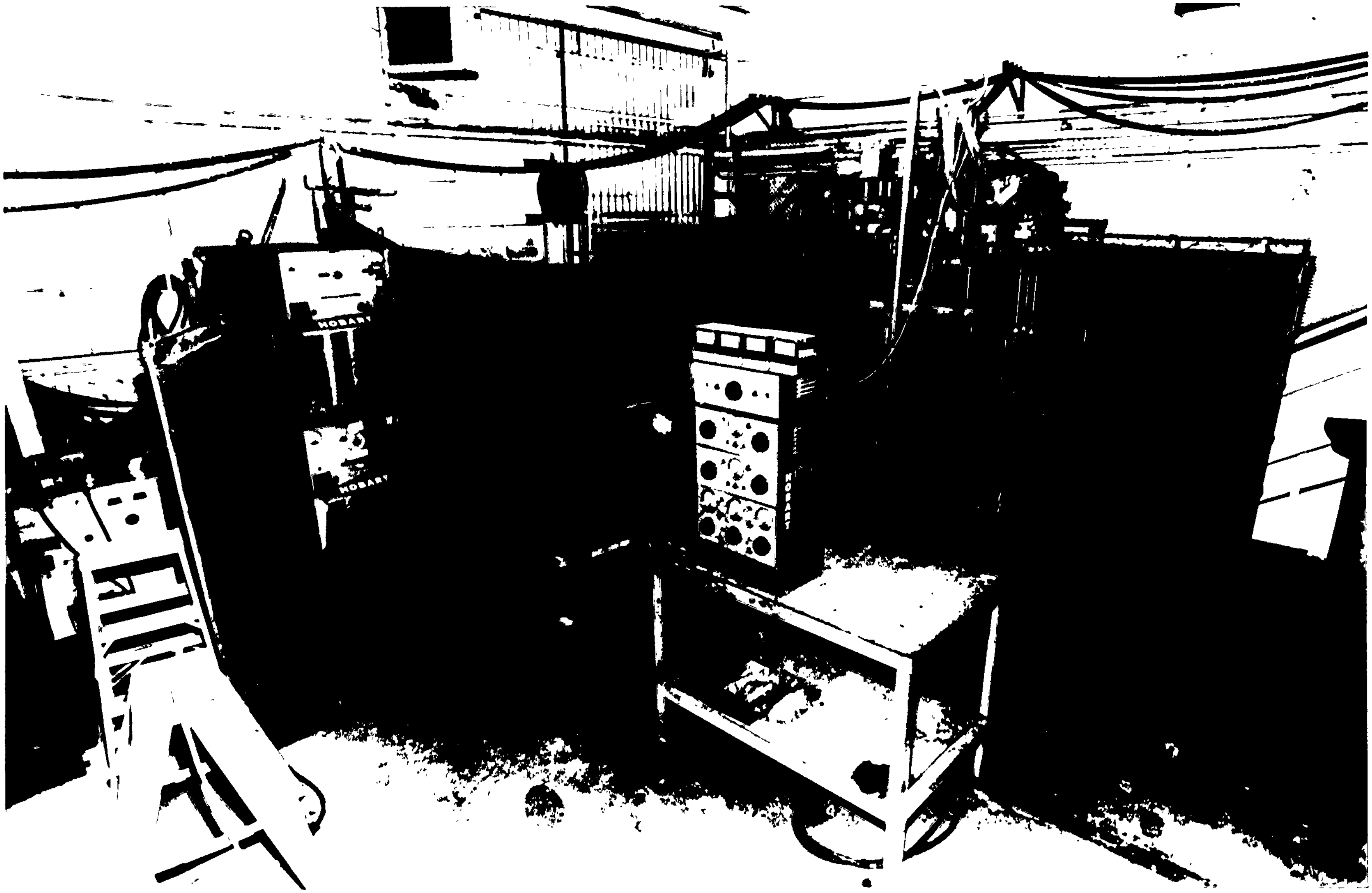


Figure 4
Equipment Configuration for Shaft Strut Mockup

Figure 5
Hobart RC-1OOO Power Supplies

Water-cooled copper retaining shoes with hoses and in-line thermometers
Small magnetic base mirrors (for seeing into the joint)
Lincoln digital wire feed speed indicator
Weston 0-100 V calibrated voltmeter
Markal temperature crayons
Steel wool
Oxyfuel heating torch with large tip.
Stopwatch (for checking dwell time, start time)
-Arc time recorder
Heat-resistant putty (for sealing shoes) - Caution: Some compounds may contain asbestos!
Insulated container for dispensing flux - Must be able to hold 250°F heated flux without damage

Safety Items

The ESW-CG process can rapidly become dangerous when not properly operated. Large quantities of molten metal, near-boiling water, and the usual popping and spitting of molten flux can all cause severe injury. The following precautions should be taken:

(1) Head Cover - either a cap or hard hat (if overhead cranes are present) is needed.

(2) Ear Protection - full coverage ear muffs should be worn.

(3) Eye/Face Protection - Wear a protective full face shield during all work near the weld. Safety glasses should always be worn. Use burner's goggles (Shade 5 or 6) to look at the molten slag in a mirror only after the ESW mode has been attained.

(4) Heavy welding clothing should be worn by anyone near the weld (including observers!). Gloves should be worn at all times except when operating the control panel.

Method

Initially, a thorough search of recent literature concerning ESW-CG was performed and, along with later articles of interest, compiled into a bibliography. This search included use of the DIALOG "Weldasearch" program to investigate a larger, international database.

After completing the literature search, the first range of thicknesses was welded in the following increments: 4", 6", 8", and 11". The second range of thicknesses consisted of 13", 16", 19", 22" and 24" joints. For the purposes of this report, the joint dimensions shall be as shown in figure 6.

Joints of each of the aforementioned thicknesses were welded until at least one acceptable joint of each thickness was obtained. An acceptable joint is one that had no visible or RT (when the joint thickness was less than 20") indications. Macro sections were used in lieu of RT for some thicknesses. In the case of the 11" thickness, several joints, including a full scale mockup, were welded to refine parameters to be used on the production shaft struts.

Starting the welding operation is the most difficult and complex aspect of ESW-CG. Two operators are required (particularly for greater thicknesses) and must work closely together to get the process underway. One of the operators should be responsible for operating the control panel, checking parameters and adjusting coolant flow. The other operator should be stationed. near the joint opening in order to give the starting commands, add flux, make necessary oscillation changes, and check the color of the joint sides and/or slag bath: Both operators should be watching for wire stoppages, slag leaks, excessive water temperature, excessive popping, etc.

There are many different starting variations, but each variation follows the same basic rules. Each arc must be initiated and covered with dry flux. This dry flux is melted by the heat of the open arc, and forms a puddle of molten slag. From this point on, that arc is said to be in "the electroslag mode" and the slag remains molten because of its resistance to the electrical current passing from the wire to the work. Once in this mode, the controls were adjusted and the "running" parameters were utilized. With more than one wire, the start becomes more difficult because the number of variables increases greatly. With larger guide tube spacings (usually during the greater thicknesses) it becomes harder to get the slag bath to traverse the entire joint thickness without wire stoppages. During the course of this project,

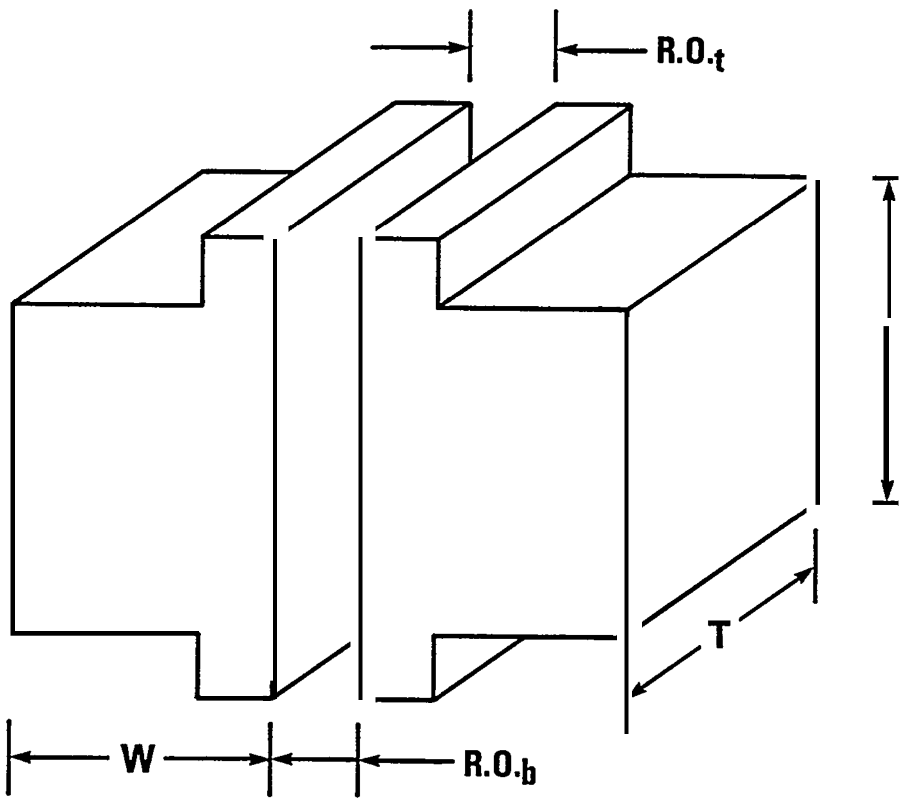


Figure 6
Typical Joint Dimensions

problems were encountered with starting techniques. As a result, an evaluation of the starting process was performed.

In order to evaluate the various starting variations, a special “starting butt” was designed to allow the operator to easily see what was taking place at all times. The “starting butt” configuration is shown in figure 7. After working with the short starting butt, a simple, reusable "blinder” was added to simulate actual joint conditions. This blinder had a small viewing port for an observer to assist the operator in learning to read the puddle. Some of the variables researched included: preplaced flux, oscillation during the start, guide tube cleaning methods, voltage, amperage/wire feed speed, flux type and guide tube spacing. For example, the arrangement shown in figure 8 was used to record simultaneous amperages below the last bussed connection - in this case the last row of spacers. It showed the differences in process stability with different fluxes, and also the actual mechanism of an “arc-out” weld stoppage. An “arc-out” can be encountered where more than one wire is not in the electroslag mode, and a wire actually welds itself to the inside diameter of the guide tube.

Nondestructive testing of welded joints included visual inspection, some magnetic particle (MT) testing and radiography (RT) when possible (NNS’ RT capability is limited to 20 inches). When RT was not possible macro sections were examined. Mechanical property testing included all-weld-metal tensiles (AWMT), tranverse tensiles (RST), side bends (SB) and Charpy V-notch impacts (CVN). Mechanicals were performed on both heat-treated and as-welded joints.

Results

The selected bibliography and output from the DIALOG “Weldasearch” program can be found in Appendix B. This appendix provides an excellent reference list for both the first-time ESW users who are just getting started, as well as the experienced ESW users who are either problem-solving or expanding their usage. Of these references the two most helpful documents were Cary’s **Ports-Slag -Welding**, and of course, the AWS English translation of Paton's **Electroslag Welding** which is still the most comprehensive treatment of the subject to date.

Figures C-1 thru C-25 in Appendix C show the sequence of operations developed for fitup of the test assembly, preparation and alignment of the

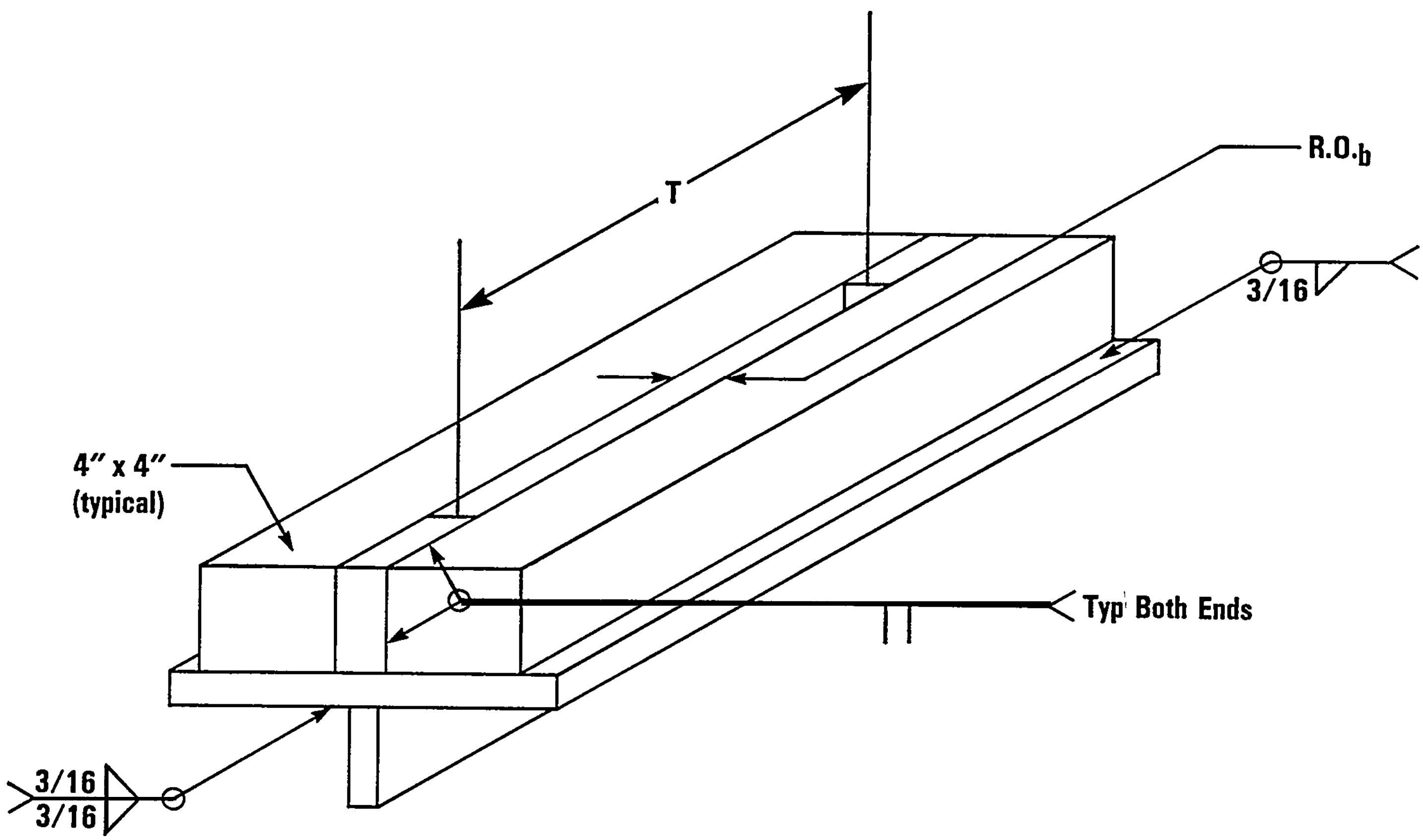


Figure 7
Special Starting Mockup

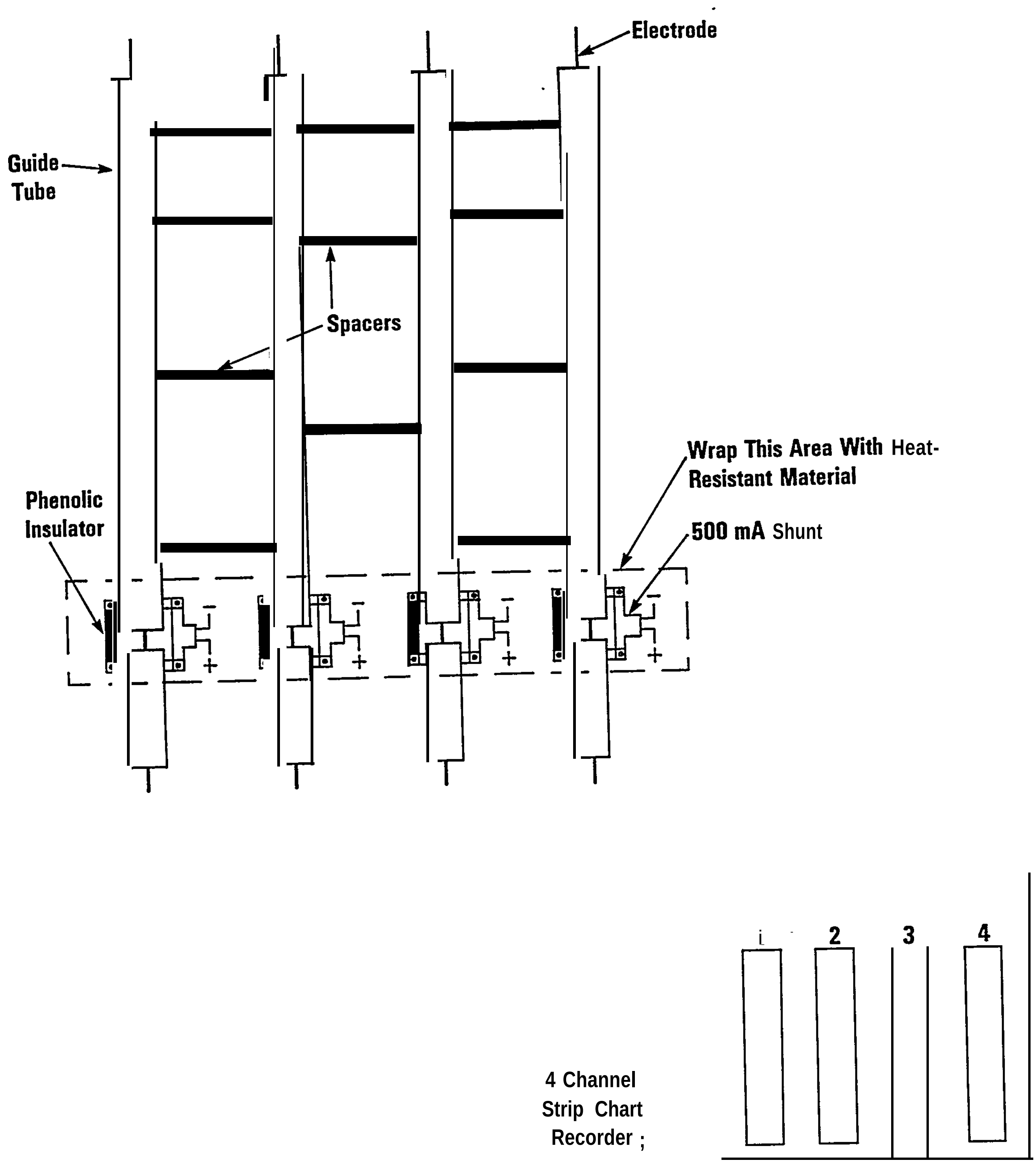


Figure 8

Guide Tube Arrangement for Recording Simultaneous Amperages guide tube rack, and preparation for welding. BY reading figures C-1 thru C-25 in order, preparation of nearly any butt joint should be possible. The only difficulty in depicting weldment preparation is the many different methods of supporting the weldment. For the cast test blocks used to develop these techniques, the methods in Appendix C were used. Larger full size weldments, such as shaft struts require special supports based on configuration and orientation. (Other ideas for preparation can be found in Hobart's book Porta-Slag welding). Included in each figure are "helpful hints" learned from experience that can reduce the total preparation time.

Appendix D contains the welding data sheets for joints welded during the evaluation as well as the visual and nondestructive test results for those joints. Mechanical testing results can be found in figures 9 through 14. Figure 15 is a comparison of CVN values from: a) the MIL-S-15083 Grade B base material, b) from a weld with Linde L-124 flux and c) a weld made with Hobart PF-203 starting flux. A comparison of simultaneous amperages for identical welds is shown in figure 16 using L-124 flux vs. PF-203 flux.

Appendix E contains information pertaining to the procedure qualification of ESW for use on production shaft struts, and includes the technical report which was submitted to and approved by NAVSEA.

Discussion

The first range of thicknesses - 4 through 11 inches - presented very little difficulty from a welding standpoint. M685-1 and -2, each 6" thick, were both welded successfully and had acceptable RT results. M685-1 was heat-treated at 1200°F for 6 hours, and compared to the as-welded M685-2 through standard mechanical testing (see figures 9 and 10). The heat-treated joint had lower (but acceptable) tensile and yield strength, higher impact strength, and satisfactory side bends. The joint tested without heat-treatment had unsatisfactory side bends, as expected, because of the typically large coarse grains.

Joints M685-3 and -4 were 4" thick and were welded with good results. M685-3 was cross-sectioned and macro-etched with no visible discontinuities. M685-4 was radiographed and rejected due to indications near the top of the weld, originating in the run-off tab. Since acceptable mechanical results were achieved with the 6" heat-treated joint, no mechanical testing was performed on

Newport News Shipbuilding
A Tenneco Company

PQR ____
Page ____

NONDESTRUCTIVE TESTING

Method	Technique	Acceptance	Sat/Unsat	Date
	SEE WELDING DATA	SHEET M685-1		

DESTRUCTIVE TESTING

TENSILE TEST

#	Dimensions in	in	in^2	Load lbs	Tensile psi	* L
9A	.998	1.969	1.965	131600	66972	W
9B	.999	1.846	1.844	123100	66757	W
9C	.988	1.497	1.494	100500	67269	W
2A	1.000	1.970	1.970	135000	68528	B
2B	1.000	1.850	1.850	128700	69568	W
2C	.999	1.500	1.499	104200	69573	W
	in	RA	EL	YS	TS	—
AWH	.505	61.1%	32.0%	45,000	68,000	—

*L - location of failure; W - weld; F - fusion line; B - base metal

GUIDED BEND TEST

R= 3/4" Dimensions- 3/8" x 2"

#	Sat	Unsat	#	Sat	Unsat
8A	S		3A	S	
8B	S		3B	S	
8C	S		3C	S	
6A	S				
6B	S				
6C	S				

S - side; F - face; R - root

IMPACT TEST

#	Loc.	Type	°F	ft lbs	Lateral Exp. mils	%	% Shear
1A	WELD	CVN	+72	59	55	14.0	40
1B			+72	57	48	12.2	40
1C			0	12	12	3.0	20
1D			0	49	46	11.7	20
1E			-60	10	6	1.5	1
1F			-60	5	2	.51	1
5A			+72	83	66	16.8	40
5B			+72	74	66	16.8	40
5C			0	14	13	3.3	10
5D			0	17	17	4.3	10
5E			-60	3	0	0	1
5F			-60	3	0	0	1
10A			+72	67	58	14.7	30
10B			+72	82	67	16.0	30
10C			0	12	9	2.3	1
10D			0	10	17	4.3	1
10E			-60	3	0	0	1
10F			-60	3	0	0	1

DEPOSIT ANALYSIS

Laboratory Services Number: 9204-W (M685-1)

P. D. Thomas 1/1/[illegible]
Welding Engineer

FIGURE 9

Newport News Shipbuilding
A Tenneco Company

PQR
Page

NONDESTRUCTIVE TESTING

Method	Technique	Acceptance	Sat\Unsat	Date
	SEE WELDING DATA	SHEET M685-2		

DESTRUCTIVE TESTING

TENSILE TEST

#	Dimensions in	in	in'	Load lbs	Tensile psi	* L
1A	1.000	1.750	1.750	137100	78325	B
1B	1.000	1.753	1.753	138400	78956	W
1C	1.000	1.752	1.752	135800	77511	B
2A	.997	1.760	1.755	134200	76467	B
2B	1.000	1.756	1.756	130,300	74203	B
2C	.998	1.758	1.754	123600	70468	B
	in	RA	EL	YS	TS	
AWM	.505	30.8%	17.5%	54,000	82,400	—

*L = location of failure; W - weld;
F - fusion line; B - base metal

GUIDED BEND TEST

R= 9/16"	Dimensions- 3/8" x 1 3/4"				
#	Sat	Unsat	#	Sat	Unsat
1A		S	1C		S
2A		S	2C		S
3A		S	3C		S
1B		S			
2B		S			

S - side; F - face; R - root

IMPACT TEST

#	Loc.	Type	°F	ft lbs	Lateral Exp. mils	%	% Shear
H1	HAZ	CVN	+72	7			
H2			+72	8			
H3			0	3			
H4			0	5			
H5			-60	3			
H6			-60	3			
F1	F.L		+72	28			
F2			+72	40			
F3			0	5			
F4			0	4			
F5			-60	3			
F6			-60	3			
W1	WELD		+72	31			
W2			+72	36			
W3			0	9			
W4			0	13			
W5			-60	4			
W6			-60	4			

DEPOSIT ANALYSIS

Laboratory Services Number:
6842-W
(M685-2)

Welding Engineer

Newport News Shipbuilding
A Tenneco Company

PQR
Page

NONDESTRUCTIVE TESTING

Method	Technique	Acceptance	Sat\Unsat	Date
565 O&mw-1	Dll"rA E+IEEX tM@5-3\			

DESTRUCTIVE TESTING

TENSILE TEST

#	Dimensions in	in	in^2	Load lbs	Tensile psi	* L
1-1	1.003	1.788	1.793	138300	77133	B
1-5	1.000	1.788	1.788	138400	77404	B
2-1	1.004	1.788	1.795	141700	78941	B
2-1	1.003	1.788	1.793	140200	78192	B
		ALL-	WELD-	METAL	TENSILE	
	in	RA	EL	TS	YS	
1	.505	35.8%	17.5%	86780	56,500	

*L - location of failure; W - weld; F - fusion line; B - base metal

GUIDED BEND TEST

R= 3/4" Dimensions- 3/8" x 1 11/16"

#	Sat	Unsat	#	Sat	Unsat
ALL	SIDE	BENDS	UNSATISFACTORY		

S - side; F - face; R - root

IMPACT TEST
(AVERAGE VALUES)

#	Loc.	Type	°F	ft lbs	Lateral Exp. mils	%	% Shear
1-5	WELD	CVN	+70°	22.7			
6-10	|	|	-20	4.5			
11-15	|	|	-20	4.0			
16-20	|	|	-20	3.5			
21-25	|	|	0	4.1			
25-30	↓	↓	+30	6.6			

DEPOSIT ANALYSIS

C	CR	MN	NI
.18	.35	.73	.37
MO	CU	SI	P
.04	.27	.34	.008
S			
.008			

Laboratory Services Number:
8692-Y
(M685-31)

P. D. Thomas 1/7/86
Welding Engineer

NONDESTRUCTIVE TESTING

Method	Technique	Acceptance	Sat/Unsat	Date
	SEE WELDING DATA	SHEET M685-32		

DESTRUCTIVE TESTING

TENSILE TEST

#	Dimensions in	in	in²	Load lbs	Tensile psi	* L
1A	1.001	1.644	1.646	112 500	68348	W
1B	1.001	1.720	1.722	117600	68293	W
1C	1.002	1.720	1.723	115400	66976	B
1D	1.001	1.627	1.629	110100	67587	B
2A	1.004	1.637	1.644	NO TEST		
2B	1.004	1.757	1.764			
2C	1.004	1.755	1.762	121200	68785	W
2D	1.004	1.635	1.642	113 200	68940	B

*L = location of failure; W - weld; F - fusion line; B - base metal

GUIDED BEND TEST

R= 3/4" Dimensions- 3/8x 1 5/8"

#	Sat	Unsat	#	Sat	Unsat
1A	S		2C	S	
1B	S		2D	S	
1C	S		3A	S	
1D	S		3B	S	
2A	S		3C	S	
2B	S		3D	S	

S - side; F - face; R - root

IMPACT TEST
(AVERAGE VALUES)

	#	Loc.	Type	°F	ft lbs	Lateral Exp. mils	%	% Shear
1	1-5	WELD	CVN	+70	64.0			
	6-10			-20	6.9			
2	1-5			-20	6.4			
	6-10			-20	6.2			
3	1-5			0	9.7			
	6-10			+30	34.9			

ALL-WELD-METAL TENSILE

in.	RA	EL	YS
.505	57.8%	28.0%	44753
TS			
72600			

Laboratory Services Number:
(7712-X)
M685-32

P. D. Thomas 1/7/86
Welding Engineer

NONDESTRUCTIVE TESTING

Method	Technique	Acceptance	Sat\Unsat	Date
	SEE WELDING DATA	SHEET M685-33		

DESTRUCTIVE TESTING

TENSILE TEST

#	Dimensions in	in	in^2	Load lbs	Tensile psi	* L
1A	1.003	1.844	1.850	129800	70162	W
1B	1.000	1.845	1.845	130200	70569	B
1C	1.006	1.843	1.854	128300	69202	B
1D	1.001	1.845	1.847	129800	70276	B
2A	1.006	1.746	1.756	123800	70501	W
2B	1.003	1.757	1.762	123900	70318	W
2C	1.002	1.756	1.760	124000	70455	B
2D	1.001	1.750	1.752	122700	70034	B

*L = location of failure; W - weld; F - fusion line; B - base metal

GUIDED BEND TEST

R= 3/4" Dimensions- 3/8" x 1 3/4"

#	Sat	Unsat	#	Sat	Unsat
1A	S		2C	S	
1B	S		2D	S	
1C	S		3A	S	
1D	S		3B	S	
2A	S		3C	S	
2B	S		3D	S	

S - side; F - face; R - root

IMPACT TEST
(AVERAGE VALUES)

	#	Loc.	Type	°F	ft lbs	Lateral Exp. mils	%	% Shear
A	1-5	WELD	CVN	+70	51.9			
	6-10			-20	5.8			
B	1-5			-20	7.2			
	6-10			-20	7.0			
C	1-5			0	6.8			
	6-10			+30	24.8			

ALL-WELD-METAL TENSILE

in	RA	EL	YS
.505	61.1 %	30.5 %	40,601

TS
72882

Laboratory Services Number:
7713-Y
(M685-33)

P.D. Thomas 1/7/86
Welding Engineer

FIGURE 13

Newport News Shipbuilding TENNECO
A Tenneco Company

PQR ____
Page ____

NONDESTRUCTIVE TESTING

Method	Technique	Acceptance	Sat/Unsat	Date
	SEE WELDING DATA	SHEET M685-38		

DESTRUCTIVE TESTING

NOTE: 12 RST'S PERFORMED, HIGH & LOW REPORTED.

TENSILE TEST

#	Dimensions in	in	in^2	Load lbs	Tensile psi	* L
1-3	1.002	1.610	1.613	92000	57037	W
1-1	1.003	1.823	1.828	132600	72538	W
2-3	1.000	1.611	1.611	83600	51893	W
2-6	1.000	1.818	1.818	124500	68482	W
	ALL-	WELD-	METAL	TENSILE		
	in	RA	EL	YS	TS	
	.505	21.6%	15.5%	50327	78570	—

*L = location of failure; W - weld; F - fusion line; B - base metal

GUIDED BEND TEST

R= 3/4" Dimensions- 3/8" x 1 3/4"

#	Sat	Unsat	#	Sat	Unsat
ALL SIDE BENDS UNSATISFACTORY					

S - side; F - face; R - root

IMPACT TEST
(AVERAGE VALUES)

#	Loc.	Type	°F	ft lbs	Lateral Exp. mils	%	% Shear
1-5	WELD	CVN	+70°	26.1			
6-10			-20°	3.8			
11-15			-20°	3.8			
16-20			-20°	4.2			
21-25			0°	6.5			
25-30			+30°	9.8			

DEPOSIT ANALYSIS

C	CR	MN	NI
.22	.15	.71	.12
MO	CU	SI	P
.04	.09	.35	.013
S			
.013			

Laboratory Services Number:
8691-Y
(M685-38)

P. D. Thomas 1/7/86
Welding Engineer

FIGURE 14

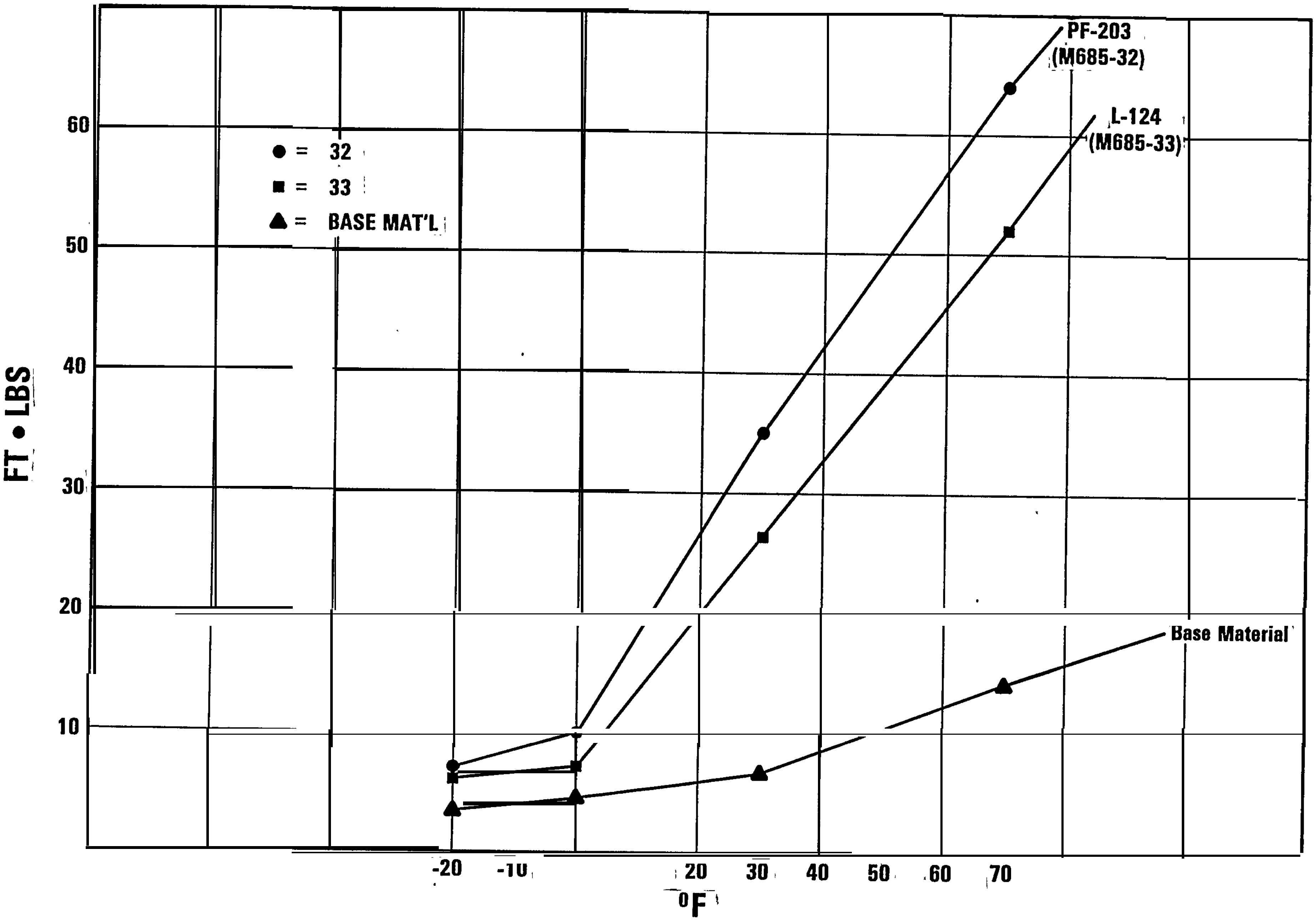


Figure 15
Comparison of CVN Values: Base Metal, M685-32, M685-33

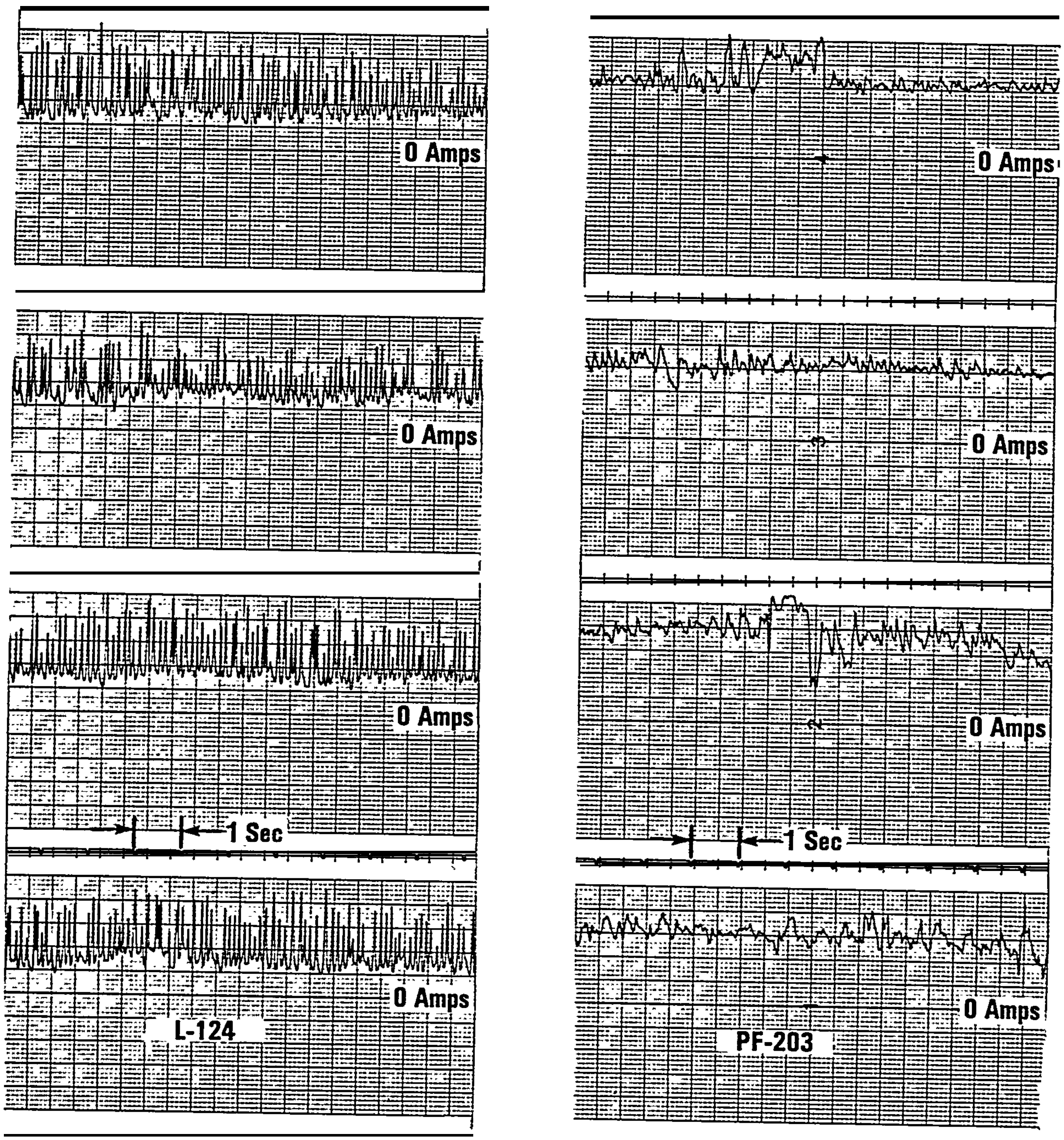


Figure16
Comparison of Simultaneous Amperages: L-124 vs PF-203

4“ thick joints. Later investigation (near the end of the project) showed these types of discontinuities to be slag-filled shrinkage voids which are typical of all ESW welds in the absence of an adequate run-off. “Paton’s Electroslag weldin pages 160-162, states:

> “Under all welding conditions, cracks and shrinkage cavities are observed at the extremity of the weld...it is essential to extend the weld 80-100mm beyond the end of the joint” . . . .

To avoid these types of defects, a run-off of at least 4“ is necessary. This 4 inch dimension is the length of weld needed beyond the top of the casting to ensure that there are no shrinkage cracks or voids in the weldment. This was graphically illustrated during the project when the weld was extended only one inch into the run-off tabs. This resulted in.the last three inches of weld in some of the weldments having shrinkage voids. Figure 17 is a classic example of these shrinkage voids in a 22” thick casting.

A total of four 8“ thick joints were welded with acceptable results. The first joint, M685-5, was RT acceptable after repairing shallow LOF indications on one side. The next joint, M685-10, was welded essentially the same, except for a lower coolant flow rate which seemed to eliminate the previous LOF. No mechanical testing was performed on these two joints.

At the 11” thickness, several joints were welded to establish, develop, and check the parameters for the shaft strut weldment. See figure 18 for a graphic description of the production shaft strut setup, procedure and mechanical results. Figure 19 shows a comparison of the ESW joint design and welding time versus the old fabrication method. After the procedure qualification was performed and submitted for approval, a 50” long mockup of the strut was welded (figures 20 and 21). Three shorter joints (84-92-1,-2,-3) *were* also welded to prove technique consistency. All of these joints were visually and radiographically acceptable. Figures 22 through 24 are photographs of the fitup and preparation of the actual production shaft struts. As part of this project, six 11” joints were welded. Joints M685-6,-11,-12,-15 and -18 were all visually and radiographically acceptable. Figure 25 shows a microphotograph of M685-18 in the as welded condition. only M685-13 was visually unacceptable, with LOF on both sides for the full length of the joint, apparently due to low coolant flow.

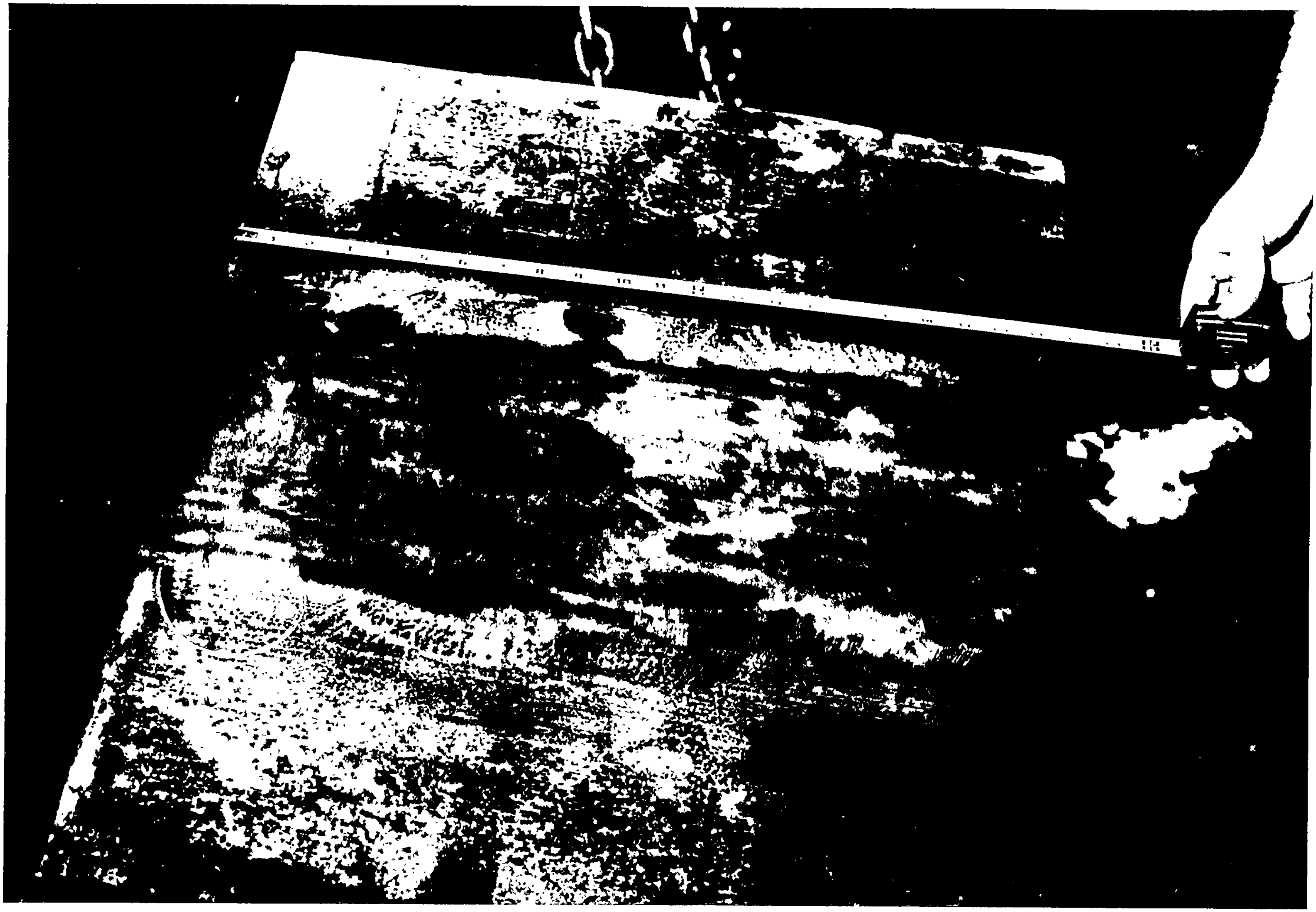
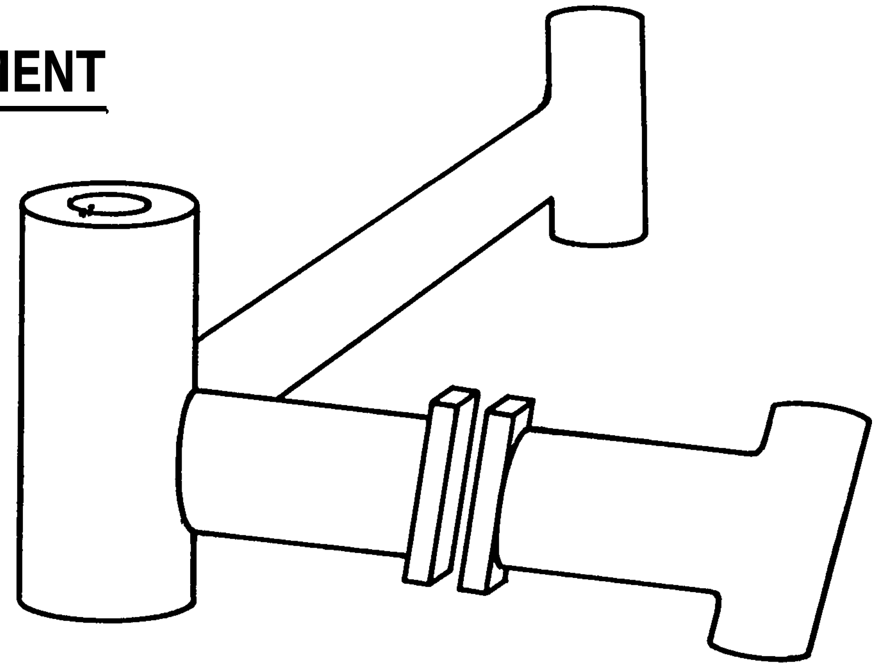


Figure 17
Shrinkage Voids in ≃22″ Thick Joint

STRUT ARM WELDMENT



WIDTH APPROX. 11“ LENGTH APPROX. 48”

BASE METAL — MIL-S-I 5083 GRADE B

THREE GUIDE TUBES WITH OSCILLATION

PARAMETERS	AMPERAGE (AMPS)	VOLTAGE (VOLTS)
	300-440	50-55

MECHANICAL PROPERTIES	TENSILE (Psi)	CHARPY “V” “ (ftlbs at +70°F)	BENDS (2T)
	70,000 to 73,000	WELD 31.4 B.M. 14.2	SATISFACTORY

Figure 18
Production Strut Setup, Procedure and Results

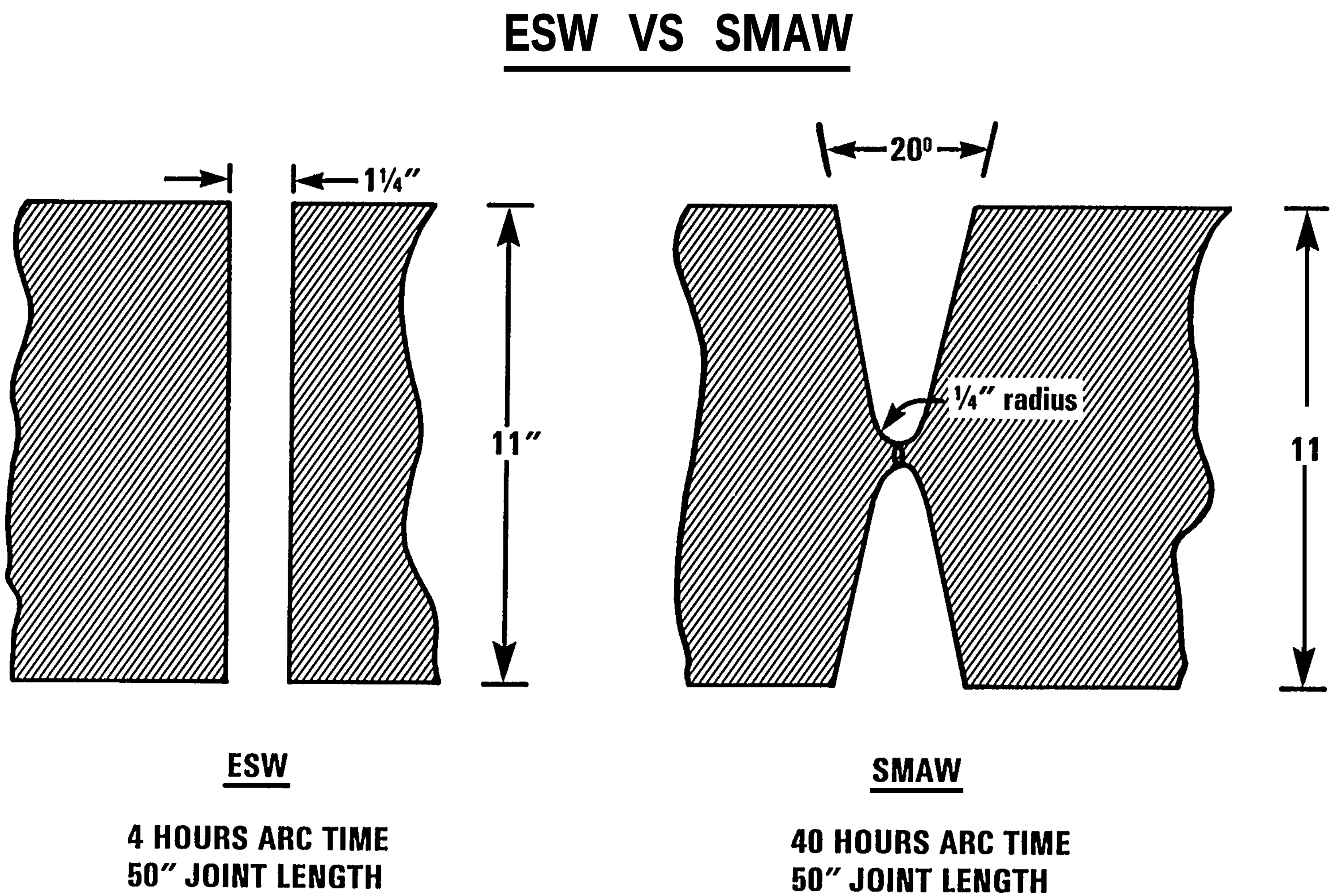


Figure 19
Joint Volume and Welding Time: ESW vs SMAW

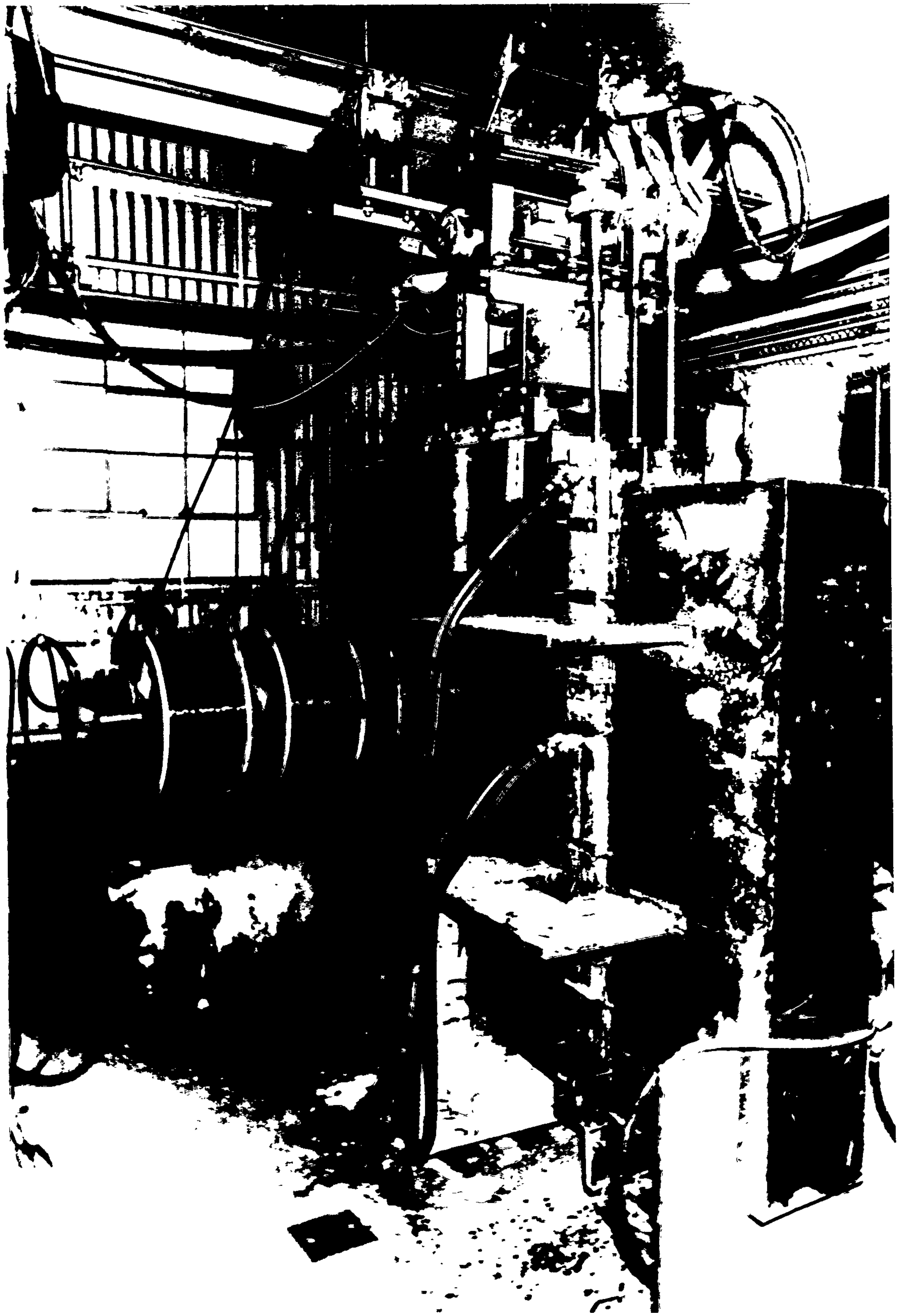


Figure 20
Shaft Strut Mockup Weldment

Figure 21
Close Up of Shaft Strut Mockup Reinforcement

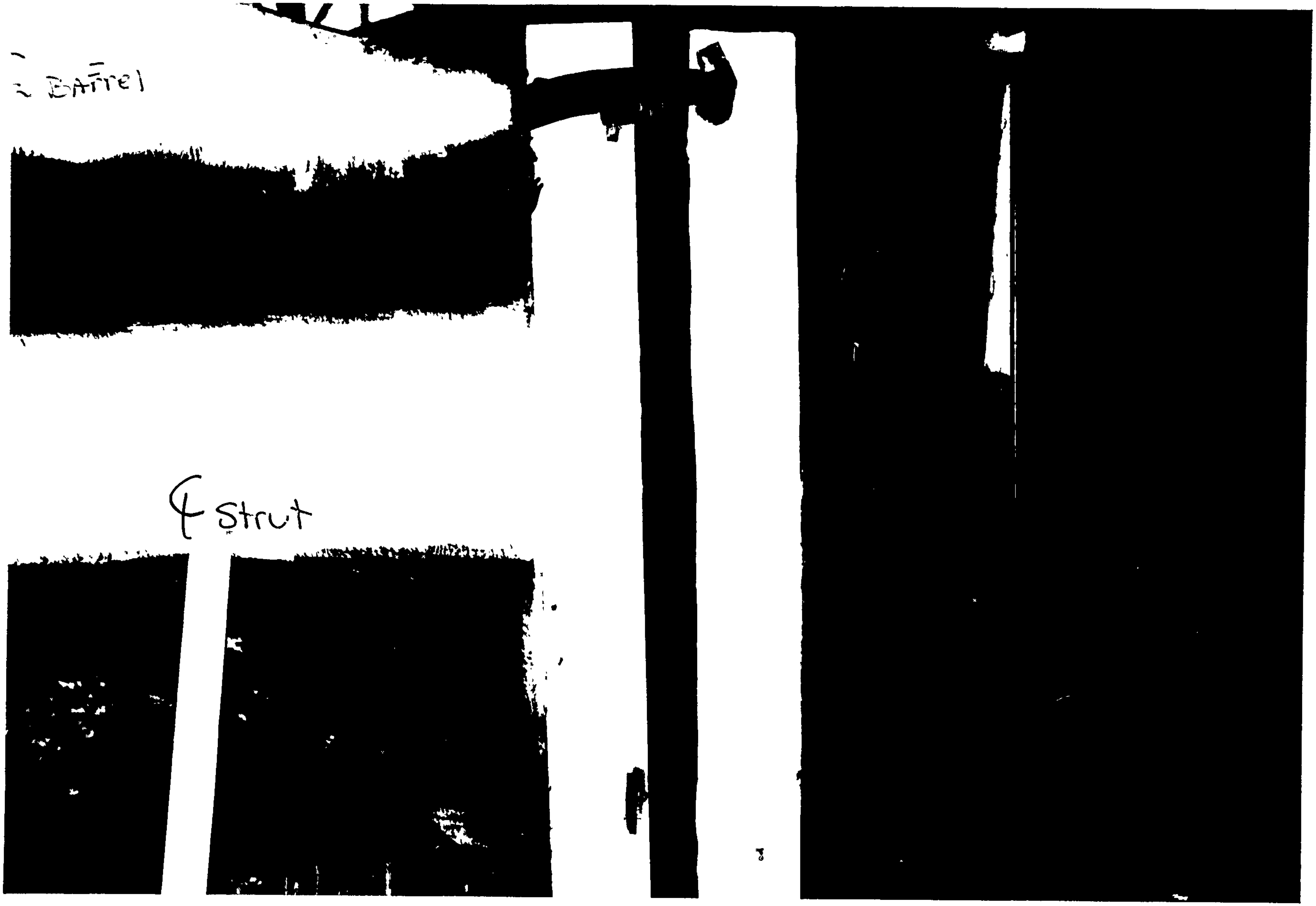


Figure 22
Fitup of Production Shaft Strut

Figure 23
Installation of Guide Tubes in Production Shaft Strut

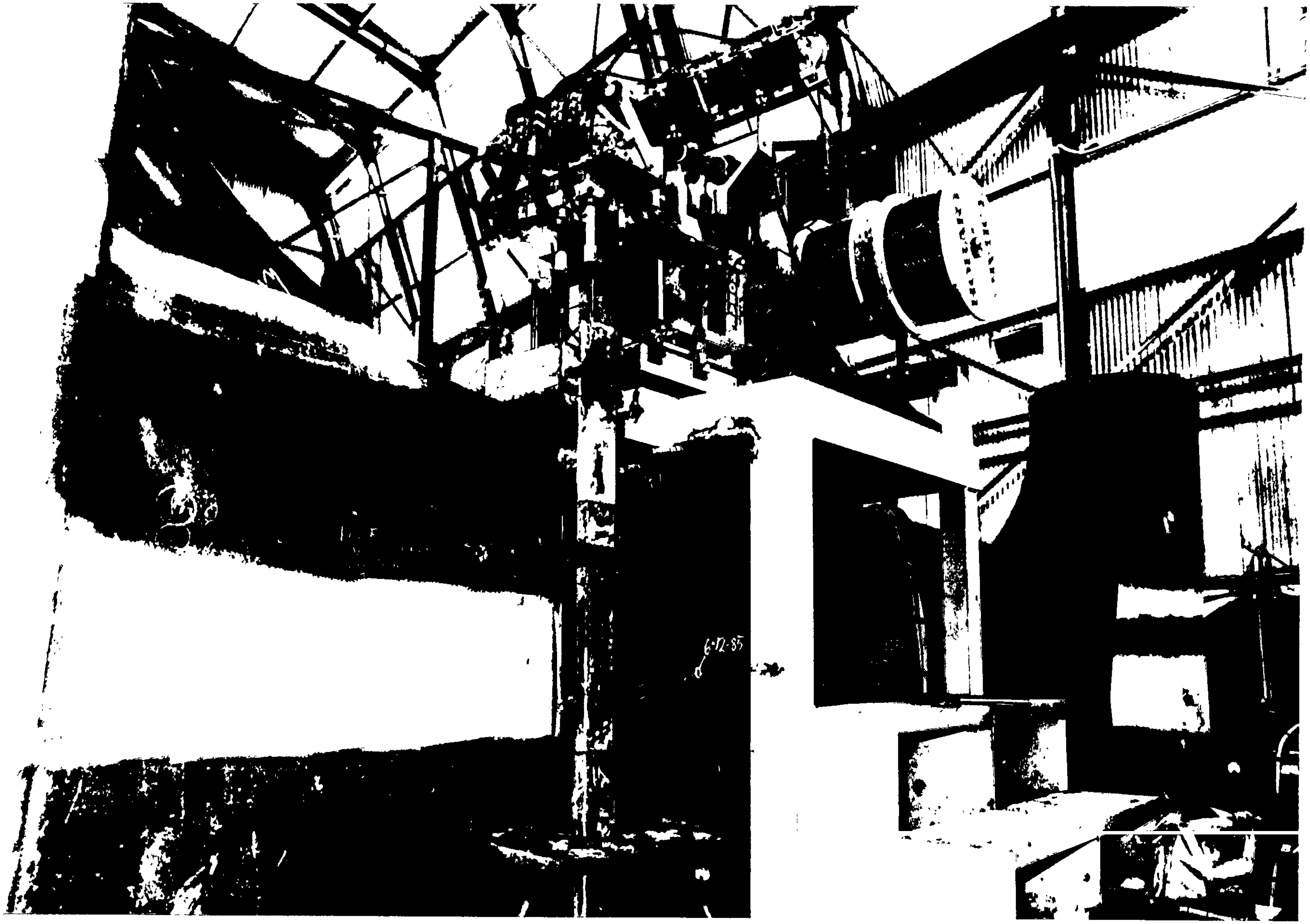


Figure 24
Installation of Cooling Shoes on Production Shaft Strut

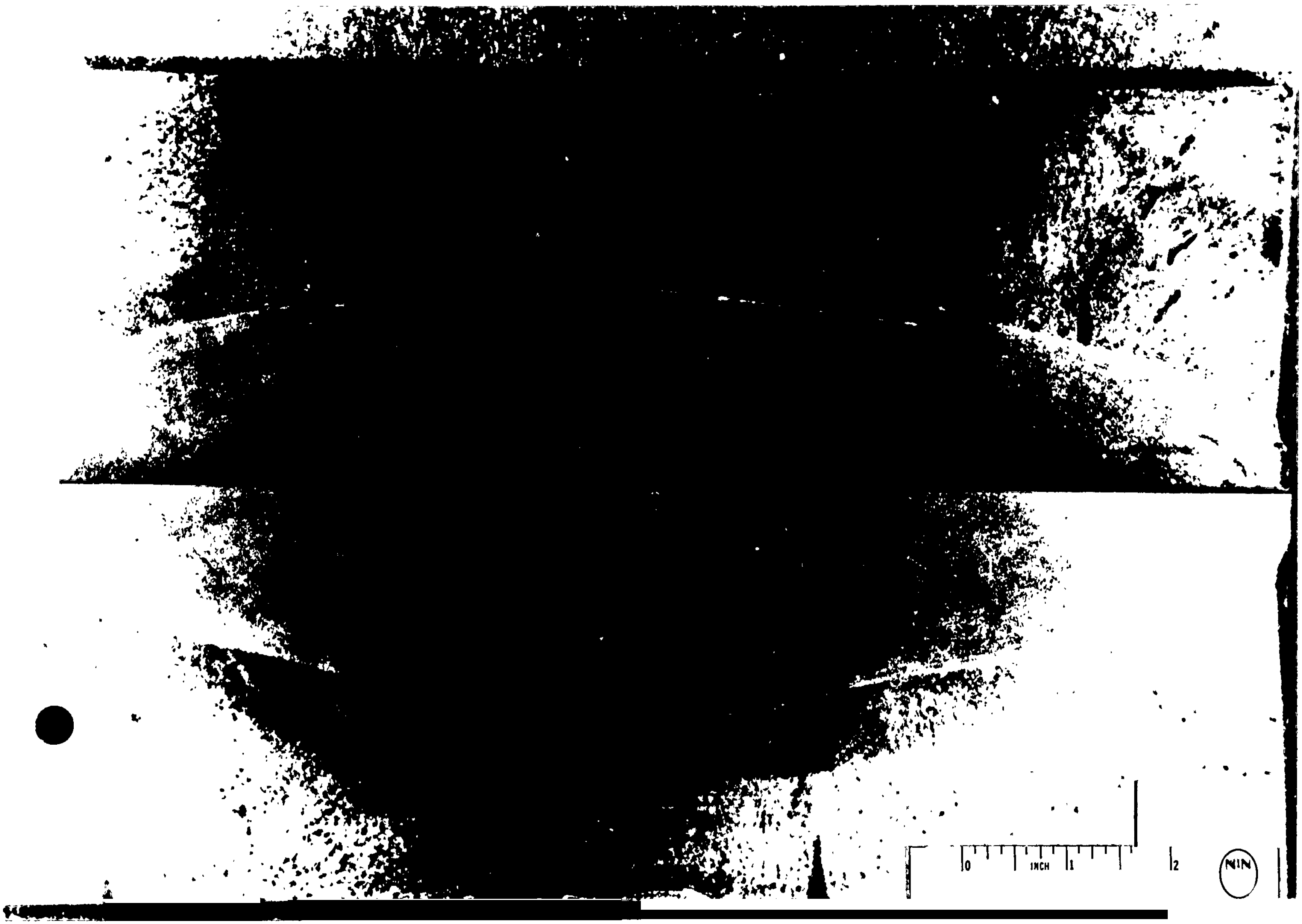


Figure 25
Macrophotograph of an 11″ Thick Weld

The second range of thicknesses, 11 through 24 inches, was also successfully covered during the project, but not as easily as the first range. TWO specific problems arose during this portion of the welding and will be addressed with the discussion of individual joints. One problem centered around the visual appearance of the weld reinforcement and the frequent occurrence of LOF discontinuities in this area. The second problem was related to the starting process for greater joint thicknesses and/or guide tube spacings. Specifically, the ability to get all of the electrodes into the electroslag mode became very difficult during the larger welds.

Many of the joints welded during the second range of thicknesses had visible lack of fusion along the weld reinforcement as shown in figure 26. Although the LOF rarely went more than 1/8″ deep, the causes for the discontinuity were evaluated *in* order to try and eliminate any repair work. Several. items were identified as potential causes. Among these were wire straightness, dwell time, cooling effect, cooling shoe location and ground location. Each of these was investigated and it became obvious that the cooling shoes were the common focal point. This caused the development of the method of locating the cooling shoes shown in Appendix C, to avoid the reinforcement depression of the shoes being off-center from the root opening. Thus, the only probable cause was the coolant effect. Initial attempts to regulate the coolant flow (measured in gallons per minute), in the hope of getting an acceptable cooling effect were difficult at best. This method still did not provide consistent=visual results. During the time we were studying the cooling effect, larger capacity (15 gallon) water coolers were substituted for the standard (3-5 gallon) welding torch cooling units. AlSO, the coolant itself was changed from deionized (D.I.) water to a mixture of D.I. water and antifreeze (50% D.I water, 50% Ethylene Glycol). These changes caused a drastic difference in the cooling effect for the same coolant flow rate, thus, the inconsistent visual results. The larger capacity coolers, and the water/antifreeze mixture were chosen as standards and another method of regulation was tried. Starting with the 19″ thickness, thermometers in the return line (the line that takes the hot coolant from the shoe back to the reservoir) were observed and various temperature levels were tried until consistent visual results were achieved. This method does not depend on coolant type or reservoir capacity, and it can be regulated by slowly adjusting the flow of coolant through the system. Temperatures ranging from 155° - 175°F provided acceptable reinforcement appearance. The coolant temperatures should

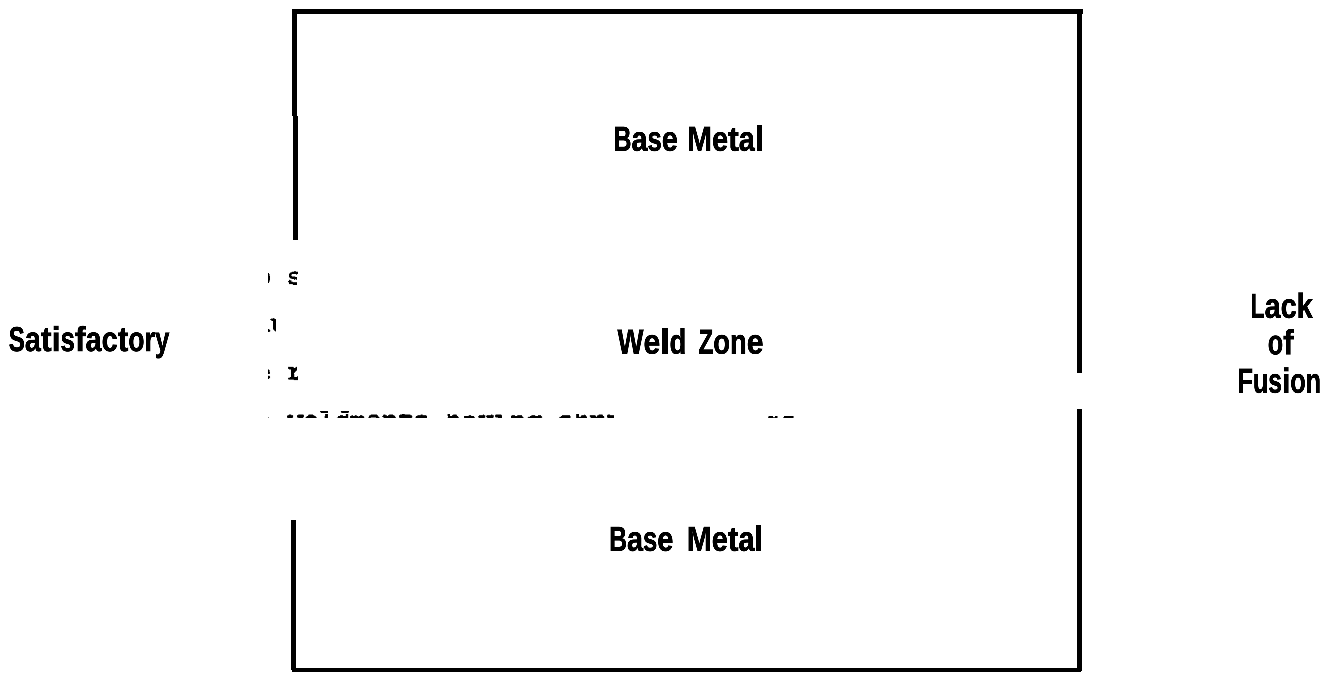


Figure 26
Typical Lack of Fusion Discontinuity

not be allowed to exceed 200°F, if water is used as a coolant, since this can cause steam to form in the hoses and may exceed the temperature rating of the hose. This method of regulating the cooling effect of the shoes then became part of the standard weld procedure. The visual appearance of the reinforcement of a successful 24" thick joint welded with this procedure can be seen in figure 27. Note the smooth transition from the weld metal into the base metal at the fusion line.

AS the project reached the 13" thickness, serious difficulties with the starting sequence began. Specifically, these difficulties appeared as wire stoppages during the starting process. Without one or more wires running, the possibility of completing a successful joint was lost. As mentioned earlier, an arc must be initiated under each electrode, and covered with dry flux. The heat of the open arc melts this flux, and at that point (when the open arc is extinguished and the slag remains molten) the electrode is in the ESW mode.

Initial attempts to determine the cause of the wire stoppages centered around the heavy spatter observed during the welding of M685-18, 19, and 19A. In order to find the starting parameters that caused the least amount of spatter, joint M685-'19B was set up as shown in Appendix C. BY using 2" thick base plate, standard jack clamp washers, and a single electrode, it was possible to witness (through a welding shield) the starting process. Various combinations of wire feed speed, voltage and flux addition were utilized. From these, it was concluded that using lower voltage (35-40) and preplaced flux around the steel wool under each wire would reduce the harmful spatter to almost none.

Joints M685-19B-1, -19C, and -19D, each 13" thick were successfully completed, but not without more starting problems. M685-19D was macro-etched and showed no discontinuities. At the 16" thickness, three joints (M685-20, -21,-22) were welded with satisfactory RT results. None of these joints had a smooth start or acceptable visual appearance at the reinforcement. Later, another 16" joint, M685-25 was welded (after determining the proper method of controlling the cooling effect). This joint had acceptable visual appearance, but was not RT'd due to the earlier RT success at this thickness. Three 19" thick joints, M685-22F,-23 and -24, were welded. M685-22F had satisfactory RT results, but none of these three joints had visually acceptable reinforcements; again due to the wrong cooling effect. The first 22" joint to be welded, M685-27 took 4 attempts to get started. After

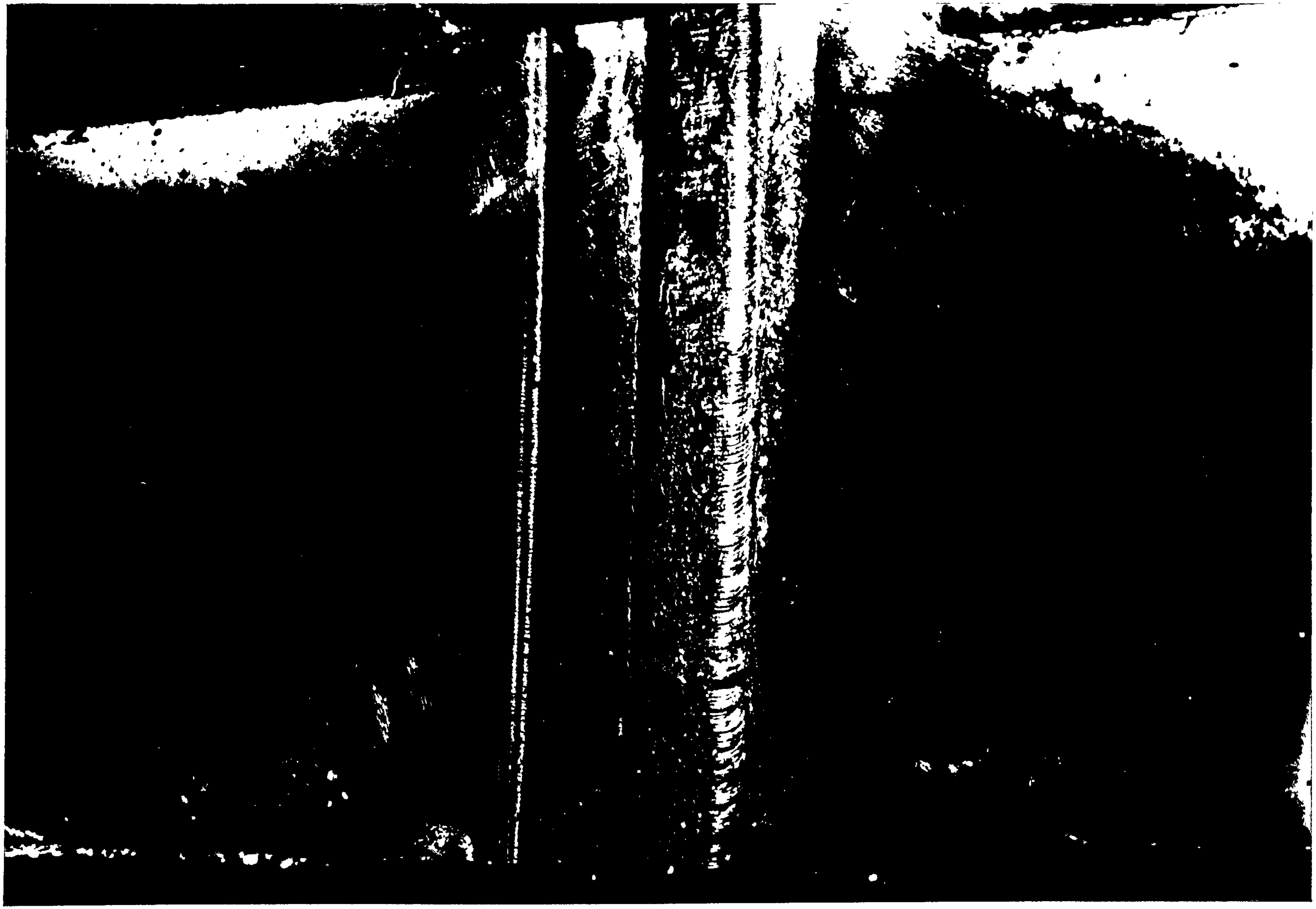


Figure 27
Accep able Weld Reinforcement

re-preparing the joint, the fourth attempt took 7-1/2 minutes to get all four wires into the ESW mode. After welding 14" of the 18" long joint, the #4 guide tube arced against the sidewall and the weld was stopped.

At this point, it was decided to futher investigate starting parameters and technique. This investigation involved researching all available reference material, contacting vendors and other users of ESW and trying several different starting methods. During this period, 36 "starting mockups" (figure 7) were welded to optimize the technique before a decent consistency level was reached. Below is a summary of the findings during this part of the investigation.

° Using a single, unbussed guide tube and wire to determine starting parameters is not advisable, since this does not' duplicate the problems encountered with a bussed system. The earlier findings are valid only for single wire systems.

° wire stoppages (generally referred to as "arc outs") are, usually not a result of spatter clogging the ends of the guide tubes. using a four channel strip chart recorder to monitor amperage below the last bussed connection, figure 8, it was possible to observe the mechanism that causes one wire to weld itself to the end of the guide tube (see figure 28). Because of the bussed connections, if more than one wire is allowed to go into the arc mode at the same time (even momentarily), one of the other wires may touch ground (the sump bottom) without enough amps or volts to burn off. When this occurs, the tube is positive and the wire negative, allowing the wire to weld itself to the tube at the end.

° These "arc outs" will occur occasionally during the starting routine, however, the other wires should still be able to go into the ESW model and then after a minute or so, the molten puddle should reach the small arc spot on the tube, melt it,

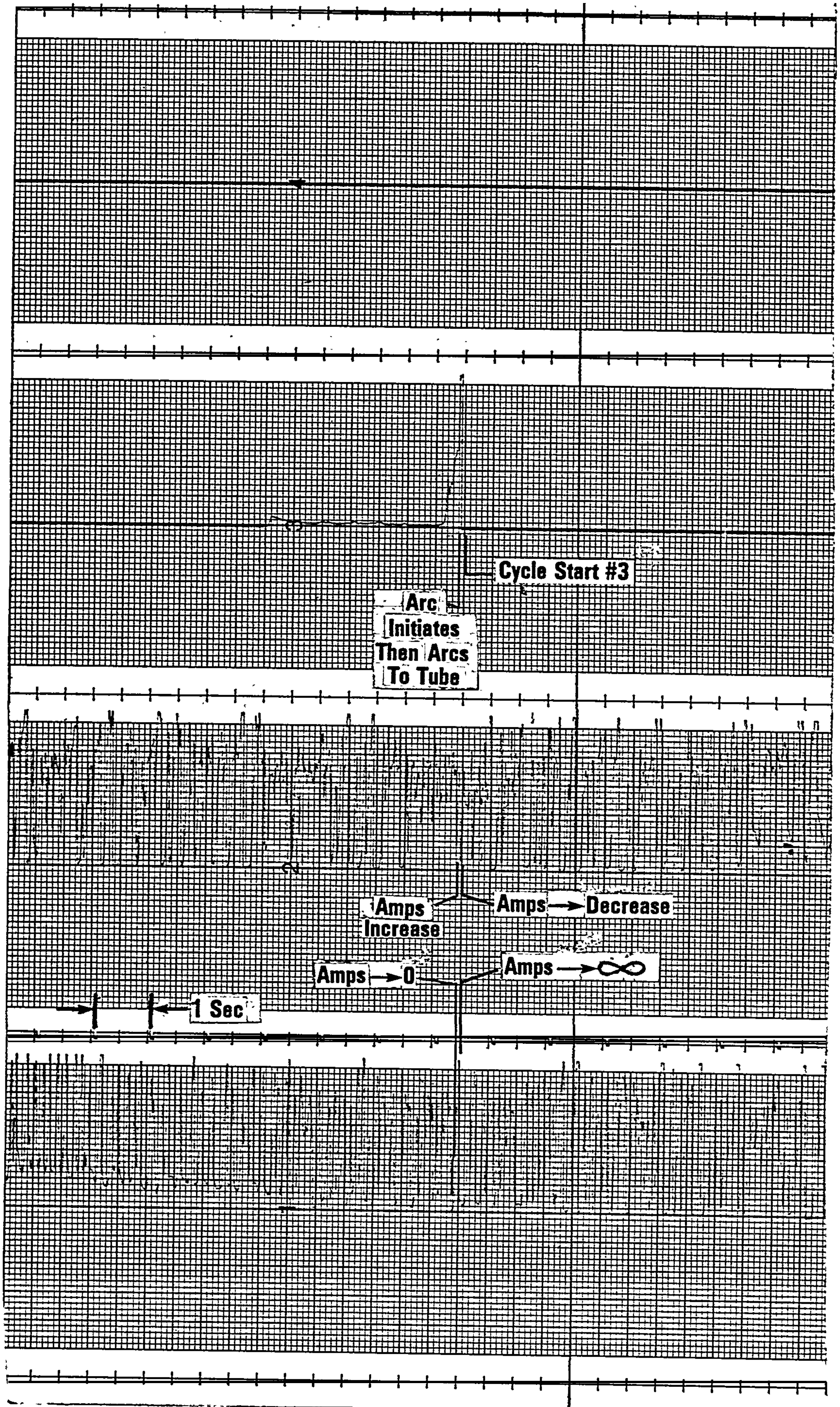


Figure 28
Mechanism of an "Arc-Out"

and allow the jammed wire to start. Also, the entire welding head can be lowered to try and melt the obstruction. All wires should be in the ESW mode within 7-10 minutes (maximum).

° Use of a "running" flux for starting the ESW process will work, but only with small thickness per guide tube values (i.e., small guide tube spacings). Starting problems were minimal at 11" using three tubes, but at 22" using four tubes starting was nearly impossible. The flux being used (Linde L-124) is indeed a "running" flux. Hobart PF-203 starting flux was obtained, and with this flux better results were achieved. The PF-203 is more conductive and has a lower melting point. This allows the wire to go into the ESW mode more quickly and helps stabilize the process. Figure 16 shows the difference in amperage readings with L-124 VS. PF-203 on the four-channel strip recorder. Notice that the amprage trace with PF-203 is much smoother than with L-124.

As a result of this information, the use of PF-203 starting flux became part of the standard weld procedure. After all electrodes were in the electroslag mode, L-124 running flux was used to increase the slag bath to the proper depth.

After attaining what was deemed an acceptable number of consistently satisfactory starts, as well as achieving acceptable visual reinforcement results, work continued as planned.

Two 22" thick butts M685-28, and -37 were welded and both were visually acceptable. M685-28 was started in 5-1/2 minutes and the deposition rate was 72 pounds per hour. A total of three 24" thick joints were successfully welded. M685-29, used to establish parameters (see figure 29), was started in seven minutes and had good visual appearance with a deposition rate of 85 pounds per hour. Joint M685-31 was welded with Hobart PS-588 cored wire (the standard wire used during this project) and was compared to M685-38 which was welded using Hobart H-25P solid wire. Both joints had satisfactory visual results and the deposition rate of M685-31 was 79 pounds per hour. Due to the high cost of heat-treating joints of this thickness, both were tested in the

Figure 29
24″ Thick Weldment

as-welded condition. Figures 11 and 14 show that neither joint passed side bends or CVN testing. The joint welded with PS-588 did have higher tensile and yield strength, and the weld deposit had higher chromium, manganese, nickel, and copper content. It is felt that either of these wires could be used to electroslag weld the low carbon steel castings used during this project, provided that suitable heat-treatment follows. TWO more 8" thick joints were welded to compare two brands of ESW flux. M685-32 was welded with Hobart PF-203 and M685-33 was welded with Linde L-124 flux, under the, same conditions. Both joints were normalized at 1600°F for 11 hours; then cross-sectioned and macro-etched with no visible discontinuities. Comparison of standard mechanical tests (figures 12,13) show that the use of PF-203 resulted in lower CVN values at -20°F and O°F, and slightly lower (although acceptable) tensile strength than the L-124 flux.

In order to complete the project, another 16" joint, M685-35, was welded using the information gathered. The joint took five minutes to start, had excellent visual results and a deposition rate of 74 pounds per hour. This was the last test needed to provide an acceptable joint at each of the specified thicknesses.

Conclusions

1. Multiple consumable guide electroslag welding is an efficient, high deposition process for joining 4 through 24 inch thick carbon steel castings that conform to MIL-s-15083 Grade B or equivalent. These weld joints will require postweld heat treatment to achieve acceptable mechanical properties. Deposition rates of up to 85 lbs/hr can be achieved.
2. Procedure qualification of multiple consumable guide electroslag welding to Navy requirements is possible using the information presented in this report.
3. The use of a "running" flux (such as Linde L-124) should be limited to guide tube spacings of less than 2-1/2 inches. A "starting" flux (such as Hobart PF-203) with a lower melting pint should be used with larger guide tube spacings to facilitate starting and then running flux added to complete the joint.

APPENDIX A

TASK PROPOSAL AND ACCEPTANCE

NN 26 (3321120)

INTER-OFFICE COMMUNICATION

NEWPORT NEWS SHIPBULDING AND DRY - COMPANY .

A Tenneco Company

To: Manager of Welding Engineering

FILE MO.

FOR: Information

DATE 10/8/82

FROM: SPC Program Manager

SUBJECT: Proposal of January 22, 1982, "Welding 4" - 24" 'Thick LOW Carbor. *Steel* Castings Using the Electroslag (Multiple Consumable Guide) Welding Process".

Reference:

(1) Newport News Shipbuilding (NNS) Contract With the Maritime Administration -- MA 80 SAC 01041.

The subject proposal has been'reviewed and approved by the *SNAME./SPC* Welding Panel SP-7 and has subsequently been approved and funded in the Fiscal *Year* 1982 Modification to the referenced contract.

NNS Cost Engineering has assigned sub-division cost number 9 to our present Job Order 1026 M and, in so doing, authorizes work to begin and all incurred costs to be charged to 1026-M-9.

M.I. Tanner

M.I. Tanner

MIT/bmc-148

1 - File Copy

Proposal

Welding 4"-24" Thick Low Carbon Steel Castings Using the Electroslag (Multiple Consumable Guide) Welding Process

January 22, 1982

Prepared by:
Newport News Shipbuilding and Dry Dock Company
E.A. Stover, Senior Welding Engineer
Newport News, Virginia for:

Ship Production Committee Panel SP-7
B.C. Howser, Manager of Welding Engineering
Newport News Shipbuilding
Nevport News, Virginia

1. **Purpose:**

This study will develop the multiple consumable guide slectroslag welding process for joining 4" **to** 24" thick low carbon steel costings.

II. Background:

Cast steel hull structural components have always presented unique problems for welding fabrication and repair. With conventional multi-pass welding processes the requirments for joint eomfiguration and preparation, preheating and Interpass control methods, weld sequencing for distortion control and in-process dimensional checks not only become fabrication bottlenecks, but also critical welding process controlling factors.

The multi-consumable guide electroslag welding process provides an alternative to the above problems. The electroslag process can be described as a welding technique which is based on the generation of heat by passing electrical current through nolten slag. The advantages in using the process include: high deposition rate; high quality weld deposit, minimal joint preparation/fitup and minimal angular distortion.

Even though the shipbuilding industry has used this process, very little work in the D.S. has been done in the area of welding thick members. The intent of this project is to develop a technique for welding carbon steel castings 4"-24" in thickness. The applcation of the *process* would *be* directed toward the joining of rudder arms shaft strut arms and other thick casting pieces. In some cases it has not bees feasible to cast these items in one piece due to their size. The electoslag welding process would significantly reduce the cost of weld fabrication and repair *of* these items.

III. Task Outline:

The task will be broken down into two phases

Phase *One:*
- Initial technique development through 10" thickness

Phase Two:
- Continue tecchnique development through 24" thickness

IV. Task Schedule, Manning and Cost: (See Figure 1)

Phase One:
- *Research* of present information available on techniques using electroslag
- Welding of carbon steel castings in progressive thicknesces from 4“s through 10"
- field mockup of a shaft strut arm
- Write Phase I report

Phase Two:

- Weld castings from 10" through 24" using information derived from Phase One
- Weld *a* dockup Of ***a*** redder stock
- Write final report

Minning :

Minning for this task is for three Den workng to various degrees for two *years.*

Cost:

Estimated cost of this project is not to exceed a budget of $1 10, 000. see Figure 2 for **a** breakdown

V. **Progress Reports:**

progress reports will be provided at the end of each quarter with a detailed final report l t the conclusion of the project.

V:. **Task Mangement and Staff:**

The project till be under the direction of a Senior Welding Engineer who till be *responsible* for the development of welding techniques and writing technical reports.

All lab work will be performed by Senior Laboratory Technicians.

Task Schedule

Months

Task Goals	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Information Research	12
Phase I Report	13
Technique Welding 10"-24" Thick Castings	23
Final Report	24

Figure 1

Project Cost Estimate

(2 Year Period)

Direct Labor		
Project Engineers	(502 time)	$ 15,000
Welding Technician	(1002 time)	30,000
Material		
Cast test blocks and constables		28,000
Testing		
Nondestructive and destructive testing		14,000
Overhead		20,000
Travel Cost		
Estimated at two trips per year		3,000
	Total	$100,000

More 2

APPENDIX B

SELECTED BIBLIOGRAPHY & DIALOG "Weldasearch"

BIBLIOGRAPHY

Brosholen, A., E. Skaug and J. J. Visser, "Electroslag Welding of Large Castings for Ship Construction," Welding Journal, 56 (August 1977), 26-30.

Campbell, H. C., "Electroslag, Electrogas, and Related Welding Processes," Welding Research Council, Bulletin No. 154, September 1970.

Cary, H. B., Ports-Slag Welding, Troy, Ohio, Hobart Brothers Technical Center, 1970.

------- Technical Guide for Electroslag Welding, Troy, Ohio, Hobart Brothers Company, 1980.

------- Linde Procedures for Consumable Guide Electroslag Welding, New York, New York, Union Carbide Corp.

Culp, James D., "Electroslag Weldments: Performance and Needed Research," Welding Journal, 58 (July 1979), 27-41.

Danhier, F. G., "Western European Techniques in Electroslag Welding," Welding Journal, 41 (January 1962), 17-23.

Dilawari, A. H., T. W. Eagar and J. Szekely, "An Analysis of Heat and Fluid F1ow Phenomena in Electroslag Welding," Welding Journal, 57 (January 1978), 24-S to 30-S.

Frost, R. H., G. R. Edwards and M. D. Rheinlander, "A Constitutive Equation for the Critical Energy Input during Electroslag Welding," Welding Journal, 60 (January 1981), 1-S to 6-S.

Konkol, P. J, "Effects of Process Parameters on Thermal Distribution During Electroslag Welding," Welding Journal, 56 (December 1977), 371-S to 379-s.

Lowe, G., S. R. Bala and L. Malik, "Hydrogen in Consumable Guide Electroslag Welds - Its Sources and Significance," Welding Journal, 60 (December 1981), 258-s to 268-s.

Lyman, Taylor, Editor, "Electroslag Welding", Welding and Brazing, ASM Vol. 6, 8th ed. Metals Handbook, 1971, p. 383-394

Norcross, J. E., "Electroslag/Electrogas Welding in the Free World," Welding Journal, 44 (March 1965), 176-186.

------- "Properties of Electroslag and Electrogas Welds," Welding Journal, 44 (March 1965), 135-s to 140-s.

Parrot, R. S., S. W. Ward and G. D. Uttrachi, "Electroslag Welding Speeds Up in Shipbuilding," Welding Journal, 53 (April 1974), 218-222.

patchett, B. M. and D. R. Milner, "Slag Metal Reactions in the Electroslag Process," Welding Journal, 51 (October 1972), 491-S to 505-S.

Paton, B. E., "Electroslag Welding of Very Thick Materials," Welding Journal, 41 (December 1962), 1115-1122.

-------"Electroslag Welding", English Translation, The American Welding Society, (Garfield Press U.S.A., 1962)

Solari, M. and H. Biloni, "Effect of Wire Feed Rate on the Structure in Electroslag Welding of Low Carbon Steel," Welding Journal, 56 (September 1977), 274-s to 280-s.

```
User22113   Date:29oct82   Time:13:10:04   File: 99

Set Items Description
  1    184 CONSUMABLE(W)GUIDE(W)WELDING
  2   1476 ELECTROSLAG(W)WELDING
  3    183  1 AND 2

Print 3/7/1-183

Search Time:  0.059   Prints: 183   Descs.:   5
```

092921
Behaviour of the slag and the fusion zone in vertical electroslag welding of cast iron plates (Comportment du laitier et de la zone...).
MICHEL A
In: Metallurgy of the Fusion Zone (Metallurgic de la Zone Fondue). Proceedings Conference, Marseille, France, 14-15 May 1981. Publ: 75880 Paris Cedex 18, France; Publications de la Soudure Autogene (for Societe Francaise de Metallurgic and Societe des Ingenieurs Soudeurs): 1981. ISBN 2-85701-052-4. Paper 06. 14pp. 15 fig., 4 tab.,
Languages: French
TWO types of unalloyed haematite iron plates were welded using either prismatic cast iron filler rods or fusible wire-guides (consumable guides) and for three different types of slag (slightly acid slightly basic, basic). The structures obtained in the different zones and problems related to inoculatim are studied. Results prove that vertical electroslag welding can be extended to cast iron, optimum conditions being obtained with the combination consumable guide/grey cast iron.

092726
Electroslag welding used to fabricate world's largest crawler driven dragline.
NORUK, d S ,. , ,, pp. 15-19. 7 fig., 2 tab. ,
Languages: English
Laboratory tests are reported on the use of consumable guide electroslag welding (ESW) in place of flux cored arc welding for full penetration welds in structural HSLA steel (to AWS standard D1.1) for construction of the carbody of large mining draglines. Advantages of ESW are discussed including increased welding speed, reduced angular distortion (and thus minimal machining time), improved weld integrity, improved weld shape and reduced exposure of men to fumes. Wire, flux and parameters were optimised to achieve adequate low temperature toughness, and AWS FES70-EWT-2 wire-flux combination was selected. Details are given of designing the solid copper water-cooled moulding shoes, and of establishing inspection standards. Some shop welding problems which had to be overcome were: erratic electrode dispensers; leakage of molten weld metal ; gas buildups: monitoring flux depth.

092564
Application to cast irons of vertical welding under slag.
MICHEL A
Translation BISI 19373. Publ : London SWIY 5DB UK: Metals Society (BIDITS); Mar. 1981. 28pp. 22 fig., 4 tab.,
Languages: English
Translated from Soudage et Techniques Connexes, VOl.33, no. 11-12. Nov.-Dee. l979. pp.357-370: Weldasearch 75393.

091972
Special features of the pulsed melting of the guide in electroslag welding.
DUDKO D A; SIDORUK V S; GORBENKO N V: MISYURENKO M A
Automatic Welding VO1.32. no.ii. Nov. 1979. PP.47-48. 3 fig., 1 tab., 3 ref.,
Languages: English
Experiments were conducted to examine the melting of the guide during the consumable guide electroslag weiding of 50mm thick specimens of steel st3, to discover the effect of increasing the cross-section of the guide and to determine the break current (background current) at which the pulsed melting of the guide changes to continuous melting.

091637
Description of the BHP-MPL .Broken Hill Proprietary, Melbourne Research Laboratories. wide plate fac'Iity and early data.
CHIPERFIELD C G
Paper presented at: Integrity of Welding Second joint AWI/NZIW Welding Convention, Christchurch, New Zealand, 12-16 Oct. 1981. Publ : Wellington, NZ; New Zealand Institute of Welding; .1981. . 4 pp. 5 fig., 2 tab., 7 ref.,
Languages: English
The wide plate testing machine at BHP-MRL, its development, capabilities and recent fracture data are described. Detaf ls are given of: specimen size restrictions: load range and accuracy; test plate preparation and insertions; features of the hydraulic and control systems; assessment of consumable guide welds in AS 1204 grade 250 steel plate (0.22%C) of 50mm thickness and comparison with the COD design curve and tolerable defect sizes.

091266
.Standards for. welding practices.
JAPANESE STANDARDS ASSOCIATION
In: JlS Handbook 1981. Welding. Pub 1: Tokyo 107 japan; Japanese Standards Association; 1981. pp.973-1040. Numerous tab. ,
Languages: English
Engllsh translations are given of japanese Standards JIS Z 3601 to 3606, Z 3621 and Z 3700 covering welding equipment, consumables, joint design and process procedures for: MMA welding of steel sheet; firecracker butt welding; submerged arc weling of mild steel sheet: TIG welding of aluminium and Al-alloys; C02 welding with solid or flux cored wires; non-shielded flux cored wire welding; consumable nozzle electroslag welding; brazing of carbon steels, copper and Cu-alloys plates and tubes: postweld heat treatment of carbon steel and low alloy steel.

090805
The long-term strengths of .electroslag. welded joints in titaniumum alloys.
KOMPAN Ya Yu; PEREPECHKO N S
Automatic Welding VOl.32, no.8. Aug. 1979. PP.40-41. 3 fig., 1 tab., 3 ref.,
Languages: English
The effects of consumable guide electroslag welding conditions on the long term stress corrosion resistance of titanlum alloys was investigated. A technology for the electroslag welding of components made of VT6 (Ti-6%Al-4%V) and VT22 alpha plus beta alloys was developed. The chemical and mechanical properties of dffferent regions of the joints are tabled. Results showing in detail the resistance of these alloys to salt corrosion under dffferent conditions are given.

090296
Weldability of carbon manganese steels and microalloyed steels (Soudabilite des aciers C-Nb et microallies).
BERNARD G; FAURE F
Report EUR 5866. Publ : Luxembourg; Commission of the European Communities: 1980. 170pp. 70 fig. 1 tab., 69 ref.,
Languages: French
A report is given of results of a research programme at IRSID, France for the period 1 jan. 1974 to 31 Dec. 1975, carried out For the European Coal and Steel Community (ECSC).
Areas covered are the cold cracking due to low energy welding of c-Mn and microalloyed steels, and the fracture toughness of weld metal and HAZ microstructures from high energy welding (e.g. submerged arc or consumable guide welding) of these steels. Selection of welding conditions to avoid cold cracking is described, including use of hardness curves and IRSID thermal efficiency diagrams. Fracture toughness of HAZs was studied on Gleeble simulated specimens and the effects of microalloying elements were examined in relation to carbonitride precipitation during the weld cooling cycle and post weld heat treatment (PWHT). Metallurgical effects of PWHT on welded joints were studied. Overall weldability of the steels is discussed.

090104
On the determination of the minimum cross-section of the consumable guide for the electroslag welding of reinforcing welds in steel columns and beams.
EVSTRATOY G I
Welding Production VOl.26, no.6. dune 1979. pp.43-44. 1 fig., 3 ref.,
Languages: English
The minimum cross section of the tubular steel consumable guide required for electroslag reinforcing welds in steel is calculated. The heat generated by the welding current is equated to the temperature rise of the components and heat losses, puttingng the maximum temperature at 400 deg.C., The steel tube outer diameter is found to be 12mm when the internal diameter is 6mm. Welding conducted using a 1.2m long guide of these dimensions at 1000A welding current shows that the guide retains its properties. The temperature distribution in the guide resulting from dipping into the slag pool is also calculated, and it is found that temperature decreases markedly a small distance from the slag pool.

087097
High productivity welding of thick plate.
VINES M J; CHIPPERFIELD C G; FANNER R
BHP Technical Bulletfn V01.25, no.2. Nov. 1981. pp.31-40. 13 fig., 5 tab., 8 ref.,
Languages: English
Artical first presented as Technical Session 3 in proceedings of conference, Welding in the Eighties, Melbourne, Australia, 20-24 Oct.1980; for abstract see Weldasearch 82911.

087093
Preventing an arc from forming between the weld edge and a consumable guide during electroslag welding.
DUOKO D A; SIDORUK V S
Automatic Welding VOl.32. no.6. June 1979. pp.43-46. 4 fig., 1 tab., 3 ref.,
Languages: English
To investigate the factors causing an arc to develop between the surfaces of a consumable guide and the edge of the work, welds were made with a PSG-500 converter or a V5Zh-630 rectifier with a gently drooping external volt-ampere characteristic, the electode positive. The AN-47, AN-8 or AN-348-A welding fluxes were used. The arc was struck as a result of the existence of a potential difference between the surfaces of a guide and a weld edge. Factors encouraging the development of an arc were overheating of the slag pool at the surface in the gap between guide and weld edge, or the formation of an arc between the electrode wire and the slag. Suggestions made to prevent an arc from forming included welding at the lowest possible voltage which ensures adequate penetration, and enlarging the gap between a consumable guide and a weld edge.

086344
Fabricating steel safely using the electroslag welding process. Part 2.
SHACKLETON D N
Welding Journal VO1 .6.1, no.1. Jan. 1982. PP.23s-32s. 5 fig., 9 tab., 3 ref.,
Languages: English
+ English .Part 1: 1bid., VO1 .60, no.12. Dec. i981. pp.244s-251s: Weldasearch 86309..
Yield strength, Charpy impact energy and critical COD values (at O deg.C) are presented, and discussed, for electroslag weld metal and heat specimens in structural steels. Topics included are the variability in properties of repeat welds; the effects of stress relieving on properties (particularly toughness); properties of as-welded, stress relieved and double-normalised weld metal in BS 4360 Grade 400 C-Mn-Si-Nb steel: IIAZ properties: and properties of consumable guide electroslag steels. Maximum allowable defect sizes in wolds are calculated from COD data and their practical implications (defect detection, fracture mechanics aspects, quality assurance) are discussed.

086311
Hydrogen in consumable guide electroslag welds - its sources and significance.
LOWE G; BALA S R; MALIK L
Welding Jurnal vol. 60 .no.12 Dec1981 PP.258s-268s . 9 fig., 9 tab.. 15 ref.,
Languages: English
+ English
The amount of diffusible hydrogen in consumable guide electroslag weld metal was measured using a mercury extraction technique for welds in 63.5mm thick A36 plate made using three commercial fluxes. The average hydrogen content was not influenced by slag cap height, current type or polarity, but was increased significantly by: applying wet asbestos: welding under an atmosphere with a high moisture content: and using water-soaked flux. Diffusible hydrogen was also higher close to the start of the weld,. The incidence and causes of intergranular cracks (found particularly in the lower portions of the welds, and at higher hydrogen contents) and solidification cracks (found rarely) are discussed.

084771
Regulating the electrical parameters of welding conditions for welding titanium and its alloys.
KOMPAN Ya Yu; PEREPECHKO N S
Automatic Welding VOl.31, no.10. Oct.1978. pp.30-32. 4 fig., 5 ref.,
Languages: English
+ English . translation of Avtomaticheskaya Svarka.
Instabilities in the consumable guide electroslag welding of titanium and some titanium alloys can result in either frozen or overheated guides. Welds from 1.5 to 3m long were made in 60 to 190mm thick titanium or alloys T1-3A1 and alpha plus beta alloys, VT6, VT22 and VT22M. Voltage drop during welding was measured and recommendations for successful , electroslag welding are given.

084278
,Electroslag. welding under electroconductive flux of large cast and forged parts used for rudders and propeller shaft supports of ships.
BROSHOLEN A; SKAUG E; VISSER J
Materiaux et Techniques VOl.67, no.1-2. Jan. -Feb. 1979. pp.51-54. ,
Languages: French
French
The results of welding massive parts by means of the consumable guide electroslag welding process with six wires are described. This method of welding can deposit 82 kg of metal/h using a current of 600A/wire and a voltage of 55V. A joint having a section 960mm x 1080mm was made between an 11 tonne casting and an 11 tonne forging in 4h 35min. Satisfactory mechanical properties were recorded across the weld.

082911
High productivity welding of thick plate.
VINES M J; FANNER R
In: Welding in the Eighties. Proceedings 28th National Welding Convention, Melbourne, 20-24 Oct. 1980.. Publ: Milsons Point, NSW 2061, Australia: Australian Welding Institute: 1980. Technical Session 3. 27pp. 13 fig., 5 tab., 8 ref.,
Languages: English
+ English
An investigation is reported on identifying high productivity welding procedures for 50mm thick plate AS 1204-250 steel (0.22%C, 0.74%Mn, 0.24%Si) using submerged arc (SAW) and electroslag processes. Processes studied were: single arc long electrode stickout SAW; twin arc SAW: tandem arc SAW; hot wire SAW and consumable guide welding. Details are given of: welding sequences; weld metal and HAZ fracture toughness values; relative costs: deposition rates; power requirements: process Parameters and. joint preparations.

082751
Long thick plate consumable guide electroslag welding.
WLSON A J
Australian Welding Journal vo1 .24, no.6. Nov. Dec, l980. PP.33-34. 8 fig. . In journal given wrongly as VO1.25, no.6..,
Languages: English
+ English
The advantages and disadvantages of consumable guide welding for long welds in thick plate are outlined. Aspects covered include: multiguide arrangements: adjustable wire feed drive systems; ways of attaching the shoes; different types of shoes: comparisons with MIG and submerged arc welding.

082689
Vertical welding of aluminium.
MASUMOTO I; SHINODAT
Journal of the Japan Welding Society VOl.46, no.9. Sept. 1977. pp.665-670. 15 fig., 1 tab., 12 ref.,
Languages: Japanese
+ Japanese
A "half-submerged arc welding" process for welding vertical aluminium plateis described and compared with eleectroslag welding (ESW). The process uses a flux-coated consumable nozzle and graphite shoes. Reduced levels of lack of fusion can be achieved at lower currents than with ESW. Findings reported include: effect of welding parameters on lack of fusion and weld metal porosity: effect of flux ratio on lack of fusion; effects of different flux compositions. Additional shielding with argon was used in some cases.

082407
Technological reliability of methods of electroslag welding of blanks of very large cross-section (Tekhnologicheskaya nadezhnost' sposobov...).
TUPITSYN L V; SEVRUK A N: SHEVCHENKO V S; ANDREEV V P
Problemy Spetsial 'noi Elektrometallurgii no.11. 1979. pp.32-34. 5 ref.,
Languages: Russian
+ Russian
Investigations were conducted into problems associated with the technological reliability of the electroslag welding of blanks with very large cross-sect ions with consumable and nonconsumable guides using wire electrodes, and also with rigid strip electrodes, with a large cross-section. The limit to Which the reliability of electroslag welding can be increased by doubling wire electrodes and drives is determined. The role of welders in the reliability of electroslag welding is outlined.

081259
Electroslag welding of curvilinear unrotated joints (Elektroshlakovaya svarka kriyolineinykh...).
SEMENOV V M; RUDOMETKININ P P: GULIDA V P; SAPIRO V B
Svarochnoe Proizvodstvo no.4. Apr. 1978. pp.36-37. 3 fig., 4 ref.,
Languages: Russian
+ Russian .nct translated in Welding Production.
The mechanism of formation of non-fusion regions (non-uniform penetration) in electroslag welding of inclined and curvilinear joints was studied. Steel test pieces of 12KhM + 0kh18N10T clad steel, of shape simulating a spherical reactor vessel end, were electroslag-welded with a consumable tip in the welder A-645. A special 'design of the consumable tip for curvilinear joints of thickness 60-100mm is proposed.

080339
Fabrication of pressed insulators of consumable nozzles used in electroslag welding (Izgotovlenie shtampovannykh izolyatorov plavyashchikhsya mundshtukov. ..).
SEMENOV V M; GULIDA V P; TIMCHENKO V V
Svarochnoe Proizvodstvo no. 1. Jan. 1978. pp.50-51. 2 fig., 1 ref.,
Languages: Russian
+ Russian. Not translated in Welding Production.
The problem of preventing contact between the guide nozzle and the workpiece in consumable guide electroslag welding, especially of large thicknesses, is discussed. The best insulators are fabricated from powder flux by pressing or from fluorite in water glass solution. A heavy-duty pneumatic press developed for producing pressed insulators in various sizes is described. Drying and hardening of the insulators ensures high strength.

076821
Application of electroslag welding to cast irons.
MICHEL A
Fonderie VO1.35, no.400. June 1980. PP.225-229. 7 fig. 2 tab., 1 ref.,
Languages: French
French
An investigation is reported on using electroslag welding on flake graphite iron (French grade Ft25) and on a nodular iron (grade FGS 50 7) using plate castings Of 12,20 and 40mm thickness. Two techniques were employed: welding with cast iron plate electrodes and weldingwith fusible wire guide. Unsound joints were obtained with the plate electrodes due to carbon activity in the slag. Withth fusible wire guide, satisfactory joints were obtained after trying a variety of wire/guide combinations, and preheating was not required. Joint mechanical properties were better with flake graphite iron than with nodular iron.

076314
Fusion welding processes.
DANN P J
Engineering Designer VOl .25. Nov.-Dec. l979. pp.7-11. 17 fig.. 2 tab.,
Languages: English
English
After a brief history of fusion welding a description and illustration (including equipment, method, consumables, operating capabilities) are given of the following processes: MMA, submerged arc, MIG/CO2, TIG, electroslag and consumable guide, arc plasma and electron beam welding. spot, seam, projection, stud and capacitor discharge processes are more briefly summarised. Other processes are listed.

076200
Productivity - the name of the game for economic survival.
WRIGHT M W
Australian Welding Journal VO1.24, no.3. May-June 1980. pp. 19-26. 6 tab., 12 ref;,
Languages: English
+ English (Paper presented at 26th Annual National Welding Conference, Adelaide, 1978).
The problems of the Australian steel fabrication industry are outlined and include: reduced local demand: competition from imports: use of concrete and aluminium as alternatives to steel : high wage costs. Making arc welding more productive is considered in detail, especially achieving higher welding speeds and deposition rates, higher operating factors, and consequently low welding costs. Replacing the currently widely used MMA (stick) welding process by continuous electrode processes is suggested, and examples of sucessful process changes are given. MMA is compared with : MIG and gas mixture metal arc: self-shielded and gas shielded flux cored arc; submerged arc including multiple head processes: and consumable guide electroslag welding. Other topics covered include: profits; quality standards; workmanship; positioning: benefits of centinuous electrode processes.

076161
Metallurgical and thermal characteristics of non-vertical electroslag welds.
JONES J E; OLSON D L; MARTINS G P
Welding Journal VOl.59, no.9. Sept. 1980. pp.245s-254s. 13 fig.. 1 tab., 23 ref.,
languages:" English
+ English (Paper presented at AWS 61st Annual Meeting, Los Angeles, 14-18 April 1980.)
A study is reported on consumable-guide electroslag welding with a non-vertical axis on AISI 501 stainless steel seamless tubes with Hobart HB-25P wire and PF-203 flux. Electrode feed rate, voltage and current were varied at different angles of inclination to find the acceptable ranges of parameters; data are presented on the effects on penetration, and fusion, zone and HAZ widths and depths. The effect of welding parameter interaction on the tendency for centreline cracking. is assessed. The inclination of the weld axis gave anisotropy of heat dstribution in the weld zone leading to anisotropy of the HAZ width and penetration depth. The process was more sensitive to welding parameters at small angles of inclination than larger ones. Radiation heat transfer from the flux pool surface is shown to be a significant factor. Satisfactory penetration can be achieved at angles up to 60 deg.

075639
Electroslag welded heavy fabrications replace large castings.
ANON
Welding News no.172. Apr. 1980. pp.11-12. 3 fig.,
Languages: English
+ English
The replacement of cast manipulating levers for handling steel ingots at Australian Iron and Steel,Port Kembla, by welded heavy steel fabrications is described. AS 1204 grade 250 steel was used with consumable guide electroslag welding. Welding procedures and equipment are outlined.

075393
Use of electroslag welding for cast irons (Application aux fontes du soudage vertical sous laitier.)
MICHEL A
Soudage et Techniques Connexes Vol .33. no. 11-12. Nov.-Dee. 1979. pp.357-370. 22 fig., 4 tab.,
Lanuaages: French
+ 'French (Paper presented to the Societe des Ingenteurs Soudeurs, Paris, 15 Nov. 1979.)
A study is reported on the welding of cast iron FT25 and FGS 50, 12, 20 and 50mm thick, by two processes: electroslag welding with prismatic cast iron or mild steel plate electrodes; and consumable guide electroslag welding with mild steel wire, covered wire which deposits a GS cast iron, graphite inoculation, refractory shoes and combinations of these. Macrographs and micrographs are presented to show the effect on weld metal and HAZ microstructure of the following: heat input; slag composition: carbon activity in the slag; use of composite electrodes: composition of welding shoes; composition of consumable guide: and inocu'lation during welding by silicon.

074744
Consumable-guide electroslag welding of steel castings. General data - plain carbon steels. '
STEEL CASTINGS RESEARCH AND TRADE ASSOCIATION
Data Sheet. Publ: Sheffield S2 3pT:Steel Castings Research and Trade Association; 1977. 20pp. 22 fig. 17 tab.,
Languages: English
English
Data are given for the consumable guide welding of steel to BS 592 : (A). (B) and (C) (now BS 3100 : A1, A2 and A3). Operating conditions, mechanical properties (including impact strengths), microstructure and hardness data are given for testpieces in 75mm and 250mm steel , welded using specified welding sequences and heat treatments.

074457
Technology and technique of electroslag welding.
AVRAMENKO V I: BOGDANOVSKY V A
In Book: Technology of Electric Arc and Electroslag Welding of Carbon and Low-Alloy Steels. Publ : 252601 Kiev-4 USSR: Naukova Dumka: 1977. Chapter 4. pp.110, 114, 121-140. 6 fig., 4 tab.,
Languages: English
+ English
The transcript of a lecture of welding engineers from developing countries is presented covering electroslag welding (ESW). The following topics are discussed: baste principles of ESW: comparison of ESW with vertical submerged arc welding: advantages of ESW for welding metal above 14mm thick, and especially above 40mm thick: quality of weld metal; ESW with electrode wires up to 5mm diameter: welding with several wires; welding in the vertical pasition; the inclined position; annular welds: ESW with solid plate electrodes; ESW with consumable nozzles; ESW with strip electrodes; process parameters (gap, voltage, welding speed and wire feed speed); carbon content of weld metal; and tensile and toughness values for some typical weld metals.

074191
Electroslag welding eliminates costly field machining on large mining shovel.
MYERS R D
Welding Journal vol.59, no.4, Apr.1980. pp.17-22. 8 fig., 2 tab.,
Languages: English
+ English (Paper presented at AWS 61st Annual Meeting, Los Angeles, 14-18 Apr. 1980.)
The field erection of a 50 cu.yd. (38 cu.m) electrically operated, open pit mining shovel is described. Particular reference is made to the assembly of the 208 ton (189 t) revolving frame made from ASTM A-588 steel. The components were welded using consumable nozzle electroslag and flux cored arc welding processes. The development of the welding methods is described and details of all consumables and welding parameters are given together with weld metal analysis and as-welded mechanical properties.

072702
Further toughness data on electroslag welds in C-Mn steels,
SHACKLETON O N
Weldina Research International VO1.9. no.5. 1979. pp.53-108. 2 fig., 15 tab., 34 ref..
Languages: English
+ English .WI Report 73/1978/M..
Crack opening displacement and Charpy impact tests have been used to examine the toughness of electroslag welds. Mild, carbon manganese and microalloyed steels of thickness 40 or 51mm were welded using 5 solid and 1 tubular wire and three fluxes using both electroslag and consumable guide welding. With care in the selection of steels and welding consumables, acceptable values of toughness could be achieved in the as-welded and stress relieved conditions. Variations in toughness between nominally similar welds were attributed to changes in the heats and batches of steel plates and welding consumables and to small differences in the welding conditions used.

071628
Fabrication of steel work for the CBA .Commercial Bank of Australia. building, Sydney.
MORRISON N G: SIM R G
Australian Welding Journal VOl .23, no.3. May-dune 1979. PP.9-12. 9 fig.,
Languages: English
+ English (Paper presented at AWI National Conference, Adelaide, 1978.)
The design of the CBA building is described in general terms and the welding of the steel work is discussed with particular reference to the 84 Vierendeel girders used. Over 3000 tonnes of structural steel conforming to AS1204 grades 250 and 350 were used to make the three-plate beams, box columns and girders which were bolted and welded around a central concrete hub and three external concrete columns to give a flexible modern interior layout with the maximum area free from columns and other intrusions. As the Vierendeel girders were so important to the structure, much effort went into their design, fabrication and testing. Consumable guide electroslag welding and both manual and automatic gasless flux cored welding (with E70T-4 wires) were used. The beams and box sections were constructed using fully automatic submerged arc welding mainly. A variety of other welding techniques were employed as needs dictated.

070921
ELECTROSIAG WELDMENTS - PERFORMANCE AND NEEDED RESEARCH.
.CULP J D
WELDING JOURNAL VOL 58 NO. 7 JULY 1979 PP.27-41. 19 FIG.,
Languages: ENGLISH
ENGLISH (PAPER PRESENTED AT US FEDERAL HIGHWAY ADMIINISTRATION ANNUAL RESEARCH PROJECT REVIEW MEETING, ATLANTA, GA, 3 OCT. 1977.)
DETAILS ARE GIVEN OF THE EXPERIENCE OF THE STATE OF MICHIGAN IN CONSTRUCTING BRIDGES IN ASTMA A36 AND A588 STEELS USING CONSUMABLE GUIDE ELECTROSIAG WELDING, AND RESEARCH INTO THE PROPERTIES OF SUCH WELDS. PROBLEMS OF WELD MICROSTRUCTURE AND TOUGHNESS ARE DISCUSSED WITH REFERENCE TO THE LITERATURE. RESULTS ARE GIVEN OF RESEARCH INTO WELD MICROSTRUCTURES (WITH ILLUSTRATIONS), AND TENSILE, SIDE BEND AND CHARPY TESTS ON WELDS - THESE TESTS (ON WELD METAL AND HEAT AFFECTED ZONE (HAZ) WERE USED AS ACCEPTANCE TESTS. RESULTS ARE ALSO GIVEN OF ENERGY TRANSITION TEMPERATURE TESTS (CHARPY TESTS ON WELD METAL, HAZ AND PARENT METAL AT -40 TO +40DEG.F (-40 TO +4.4DEG.C)), CHARPY TESTS CONDUCTED TO INVESTIGATE ANISOTROPY OF WELD IMPACT TOUGHNESS, AND TESTS OF FATIGUE NOTCH SENSITIVITY. RESEARCH STILL NEEDED IS OUTLINE.

070807
CAUSES OF GRAIN-BOUNDARY SEPARATIONS IN ELECTROSLAG WELD METALS .
KONKOL, P J; DOMIS W F
WELDING JOURNAL VOL. 58, NO. 6, JUNE 1979 PP. 161S - 167S. 8 FIG., 10 TAB., 7 REF.,
Languages: ENGLISH
ENGLISH (PAPER PRESENTED AT AWS 60TH ANNUAL MEETING, DETROIT, 2-6 APRIL 1979)
TO DETERMINE THE CAUSES OF GRAIN-BOUNDARY SEPARATIONS (SMALL CRACK-LIKE DISCONTINUITIES), A SERIES OF CONSUMABLE-GUIDE ELECTROSLAG WELDS WAS MADE UNDER CONDITIONS OF RELATIVELY LOW EXTERNAL RESTRAINT IN 1 AND 2 IN. THICK (25 AND 51MM) PLATES OF A36 STEEL. CURRENT AND VOLTAGE WERE VARIED AND SOME WELDS WERE MADE BY USING MOISTENED FLUX. TO DETERMINE THE SPECIFIC LEVELS OF MOISTURE AND/OR RESTRAINT REQUIRED TO CAUSE GARIN-BOUNDARY SEPARATIONS,ADDITIONAL ELECTROSLAG WELDS WERE MADE UNDER CONDITIONS OF RELATIVELY HIGH AND LOW EXTERNAL RESTRAINT IN 2 IN. (51MM)THICK PLATES OF A588 GRADE A STEEL. THE EFFECTS OF COOLING RATE AND POSTWELD HEAT TREATMENT WERE ALSO INVESTIGATED. THE RESULTS OF THESE STUDIES INDICATE THE GRAIN-BOUNDARY SEPARATIONS OCCUR AT RELATIVELY LOW Temperatures (BELOW ABOUT 570 DEG. F OR 299 DEG. C) AND ARE CAUSED BY THE PRESENCE OF HYDROGEN AND RESTRAINT STRESSES.

067758
JOINING OF HEAVY CASTINGS.
SANTILIIAND P D
PROCEEDINGS CONFERENCE 'WELDING AND REPAIR OF CASTINGS', WITWATERSRAND, SOUTH AFRICA, 23-24 NOVEMBER 1977. PUBLISHED: TRANSVAAL; SOUTH AFRICAN INSTITUTE OF WELDING; 1977. 21PP.,
Languages: ENGLISH
ENGLISH
THE WELDING OF HEAVY CASTINGS IN CARBON STEEL IS DISCUSSED INCLUDING THE LIMITS OF BOTH CHEMICAL ANALYSIS AND DESIGN OF THE WELD JOINT. STRESSES CAUSED BY WELDING ARE EXPLAINED AND DETAILS OF NEW RESULTS RELATING TO WELD GAP AND APPLIED VOLTAGE ARE GIVEN. IT IS POSSIBLE TO WELD LARGE CASTINGS AND FORGINGS USING THE CONSUMABLE NOZZLE ELECTROSLAG WELDING PROCESS. THE MECHANICAL TEST RESULTS GIVE EXCELLENT TENSILE VALUES . THE CHARPY V-NOTCH TEST SHOW GOOD IMPACT VALUES DOWN TO 0DEG.C. HARDNESS FIGURES ILLUSTRATE THAT THE WELD, HEAT AFFECTED ZONE AND PARENT MATERIAL HAVE VERY SIMILAR VALUES. THE DISCOVERY OF A NEW RELATIONSHIP BETWEEN VOLTAGE AND MATERIAL THICKNESS HAS SOLVED MANY OF THE PROBLEMS EXPERIENCED WHEN WELDING LARGE THICKNESSES OF MATERIAL, USING THE ELECTROSLAG WELDING PROCESS, IT IS POSSIBLE TO WELD UP TO I040MM IN THICKNESS WITH SIX WIRES. THE MECHANICAL PROPERTIES OF THE WELDED JOINTS AND THE HEAT AFFECTED ZONE OF THE PARENT MATERIAL ARE SATISFACTORY.

066298
ELECTROSLAG WELDING USING A STRIP ELECTRODE AND CONSUMABLE GUIDE (ELEKTROSCHLACKEVERBINDUNGSSCHWEISSEN MIT BANDELEKTRODE UND ABSCHMELZENDER FUHRUNG).
KILLING R; POTTHOFF F
PRAKTIKER VOL. 29, NO. 6. JUNE 1977. PP. 104-106. 10 FIG., 3 TAB .,
Languages: GERMAN
GERMAN
THE METHOD AFFORDS A HIGH FUSION PERFORMANCE AND TOGETHER WITH A SMALL JOINT GAP (15MM) ALLOWS THE WELDING OF 70-MM THICK PLATES AT THREE TIMES THE DEPOSITION RATE CUSTOMARY WITH WIRE-ELECTRDDE ELECTROSLAG WELDING AND WITH A NINE-FOLD INCREASE IN WELDING SPEED. OTHER ADVANTAGES INCLUDE A FINER CRYSTALLISATION IN THE WELD METAL AND A SMALLER COARSE-GRAIN ZONE IN THE TRANSITION REGION, EXHIBITING BETTER NOTCH IMPACT TOUGHNESS. BY FURTHER INCREASING THE WELDING SPEED, CURRENT AND WEIGHT SIZE OF THE CONSUMABLES GUIDE, THE PROCESS MAY BE FURTHER IMPROVED.

065680
THE ELECTROSLAG WELDING OF A WELDED AND FORGED 1250 TONNE PRESS FRAME . (ELEKTROSHLAKoVAYA SVARKA SVARNO-KOVANOI STANINY-RAMY PRESSA USILIEM 1250TS.)
GRINEVICH A N; POPCHENKO N Z; BELIKII P A; EVTUSHENKO A V; KOVAL I M
SVAROCHNOE PROIZVODSTVO NO.5. MAY 1977. P.39. 1 FIG.,
Languages: RUSSIAN
RUSSIAN (NOT TRANSLATE IN WELDING PRODUCTION)
THE MANUFACTURE OF A FRAME FOR A HEAVY PRESS IS DESCRIBED BRIEFLY. CONSUMABLE GUIDE ELECTROSLAG WELDING WAS USED WITH A 3MM DIAMETER WIRE. A PORTABLE ELECTRIC FURNACE WAS USED FOR HEAT TREATMENT.

065157
CONSUMABLE GUIDE (FOR) ELECTROSLAG WELDING.
BOC LIMITED
BRITISH PATENT 1 517 666. FILED: 2 NOV. 1976. (AUSTRALIA 3978175 14 NOV. 1975.) PUBLISHED: 12 JULY 1978. 1 FIG., 5 CLAIMS. ,
Languages: ENGLISH
ENGLISH
A METHOD IS DESCRIBED OF INTRODUCING A HARDENING AGENT IN CONSUMABLE GUIDE ELECTROSLAG WELDING IN WHICH MILD STEEL CONSUMABLE GUIDES ARE MELTED IN THE WELD POOL PRODUCING A WELD WHICH OTHERWISE HAS A LOWER HARDNESS VALUE THAN THE BASE METAL. THE HARDENING AGENT, SUCH AS FEMN (FERROMANAHESE) ADDED BY ATTACHING CAPSULES CONTAINING THE HARDENING AGENTS 12 TO 15MM ABOVE THE TOP OF THE JOINT. AS WELDING PROGRESSES THE CAPSULES ARE MELTED AND THE HARDENING AGENT IS RELEASED GRADUALLY INTO THE WELD POOL. USED PRIMARILY IN WELDING RAILS, THE TECHNIQUE MAY REQUIRE FROM 10 TO.30 GRAMS FEMN, DEPENDING ON THE SIZE OF THE RAIL.

064793
FRACTURE TOUGHNESS AND FATIGUE PROPERTIES OF STEEL PLATE BUTT JOINTS WELDED BY SUBMERGED ARC AND ELECTROSLAG WELDING PROCEDURES.
CULP J D
REPORT FIIWA-R-1011. PUBLISHED: LANSING MICH. 48904 : MICHIGAN DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION: TESTING AND RESEARCH DIVISION; MAY 1976. 132PP., 59 FIG., 22 TAB., 19 REF.,
Languages: ENGLISH
ENGLISH
THE FRACTURE TOUGHNESS AND FATIGUE CRACK INITIATION CHARACTERISTICS OF ELECTROSLAG (CONSUMABLE GUIDE) AND SUBMERGED ARC WELDED JOINTS, IN A36 AND A588 STEELS, WERE INVESTIGATED USING CHARPY V-NOTCH TESTS. ELECTROSLAG WELDED JOINTS APPEARED TO HAVE A NON-HOMOGENEOUS NATURE IN WELD METAL AND HEAT AFFECTED ZONE (HAZ) TESTS AT 0DEG F(-18DEG C),AND A HIGHLY ANISOTROPIC NATURE IN THE WELD METAL. CHARPY TESTS CARRIEO OUT BETWEEN -40DEG AND +40DEG F(-40 TO 4DEG C)REVEALED THE TEMPERATURE-DEPENDENT CHARACTERISTICS OF THE WELD ZONES. RESULTS INDICATED THAT SUBMERGED ARC WELDS HAD SIGNIFICANTLY LONGER CRACK INITIATION LIVES THAN ELECTROSLAG WELDS, WHICH WERE OFTEN INFERIOR TO THE PARENT METAL IN THIS RESPECT. WELD ZONE METALLURGY WAS ALSO INVESTIGATED. WELDING SPECIFICATIONS ARE RECOMMENDED.

064628
(WELDING OF) THE (ICE-BREAKING BULK CARRIER) ARCTIC.
HANNAH F J
CANADIAN WELDER AND FABRICATOR VOL.69, NO.5, MAY 1978. PP.6-8, 10, 13-17. 22 FIG., 1 TAB,,
Languages: ENGLISH
ENGLISH
THE MAJORITY OF WELDS MADE WERE COMPLETED USING AUTOMATIC SUBMERGED-ARC WELDING, CONSUMABLE GUIDE ELECTROSLAG WELDING BEING USED TO WELD VERTICAL BUTT JOINTS IN DECK PLATES. BRIEF DETAILS ARE GIVEN OF WELDING OPERATIONS, EQUIPMENT (ALL OF WHICH HAD TO BE PORTABLE) AND PROBLEMS SUCH AS HEAT TREATMENT.

064563
ELECTROSLAG WELDING OF SUPERTANKER RUDDER-STOCKS.
.BROSHOLEN A;-SKAUG E, VISSER J J
9FIG.,2TAB.METALCONSTRUCTION VOI:10 no.6 JUNE 1978 pp.297-301.
Languages: ENGLISH
ENGLISH
FOR ABSTRACT SEE WELDASEARCH 6-1386.

064280
EXPERIENCE OF THE ADOPTION OF ELECTROSLAG WELDING OF ALUMINIUM IN JAPAN. (OPYT OSVOENIYA ELEKTROSHLAKOVOI SVARKI ALYUMINIYA V YAPONII.)
SINCHUK A G
AVTOMATICHESKAYA SVARKA NO.2. FEBRUARY 1977. PP.71-72. 2 FIG.. 1 TAB..
Languages: RUSSIAN
RUSSIAN (NOT TRANSLATED IN AUTOMATIC WELDING)
CONSUMABLE GUIDE ELECTROSLAG WELDING OF LARGE PARTS IN AL REDUCTION CELLS (CROSS SECTIONS OF 150 X 500 AND 200 X 500MM) IS DESCRIBED. BEFORE THE ADOPTION OF THE NEW DEVICE MANY PASSES. AND SPECIAL HEATING OF THE EDGES TO BE JOINED, WERE REQUIRED. A MODIFIED VERSION OF THE DEVICE IS AVAILABLE FOR SMALLER WELDS. BOTH ARE HIGHLY ECONOMICAL.

064230
THE ARCTIC (ICEBREAKING BULK ORE CARRIER).
HANNAH F J
SVETSAREN NO. 1. 1978. PP. 1-7. 17 FIG., 1 TAB.,
Languages: ENGLISH
ENGLISH
THE GENERAL DESIGN OF THE M/V ARCTIC, AN ICEBREAKER FOR CARRYING CARGO IN THE CANADIAN ARCTIC, IS DESCRIBED. THE SHIP IS EXTENSIVELY REINFORCE TO WITHSTAND ICE PRESSURE. THE USE OF SUBMERGED-ARC AND CONSUMABLE GUIDE WELDING TECHNIQUES IN THE CONSTRUCTION OF THE VESSEL ARE BRIEFLY OUTLINED.

062943
EFFECTS OF PROCESS PARAMETERS ON THERMAL' DISTRIBUTION DURING ELECTROSLAG WELDING.
KONKOL P J
WELDING JOURNAL VOL. 56, NO. 12, DEC. 1977. PP. 371S-379S. 12 FIG., 5 TAB., 2 REF.,
Languages: ENGLISH
ENGLISH
A SERIES OF EIGHT WELDS WERE MADE IN 241N. (0.61M) WIDE A588 GRADE A STEEL PLATES, OF 1IN, (25.4MM) AND 4 IN. (I02MM) THICKNESS, USING A CONSUMABLE GUIDE ELECTROSLAG WELDING PROCESS. THE VARIABLES STUDIEO WERE SHOE TYPE (WATER COOLED COPPER SHOE/SOLID COPPER), GUIDE TYPE (SINGLE OSCILLATING/TWO FIXED), PLATE THICKNESS AND WELD LENGTH. TEMPERATURES WERE MONITORED DURING AND AFTER WELDING BY MEANS OF THERMOCOUPLES EMBEDDED AT VARIOUS DISTANCES FROM THE GROOVE FACE.

062894
(CONSUMABLE GUIDE) ELECTROSLAG WELDING METHOD.
BABCOCK AND WILCOX COMPANY
BRITISH PATENT 1 495 855. FILED: 25 FEB. 1975. (USA 491 447, 24 JULY 1974). PUBLISHED: 21 DEC. 1977. 5 FIG., 1 TAB., 6 CLAIMS. .
Languages: ENGLISH
ENGLISH
THE PROCESS DESCRIBED INVOLVES USE OF FLUXES IN FIBROUS FORM MADE BY POURING MOLTEN FLUX THROUGH A JET OF AIR. THE FLUX INCLUDES AT LEAST 25 PER CENT SIO2 (UP TO 40 PER CENT) AND: 10-25 PER CENT CAO, 13-14 PER CENT AL2O3, 7-8 PER CENT MGO, 7-65 PER CENT CAF2, AND 7-25 PER CENT MNO2. A REFRACTORY FIBRE IS USED TO SEAL THE COOLING SHOE/WORKPIECE INTERFACE. VARIOUS COMPOSITIONS OF FLUXES ARE GIVEN AND THE DIMENSIONS OF GUIDE PLATES, CAVITY WIDTHS AND BLANKET THICKNESS ARE GIVEN.

062657
WIDE PLATE TESTS ON HIGH HEAT INPUT WELDMENTS IN C-MN STEELS .
HARRISON J D; SAUNDERS G G
WELDING RESEARCH INTERNATIONAL VOL. 7, NO. 4. 1977. PP. 277-297. 11 FIG., 7 TAB., 6 REF.,
Languages: ENGLISH
ENGLISH
AN INVESTIGATION INTO FRACTURE TOUGHNESS OF 3 STEELS (DOMEX 3600, DOMEX 450TD, OX602D) IWCLUDED STUDIES OF 5 WELDING PROCESSES. THESE INCLUDED 2- AND 1-SIDED SUBMERGED ARC, 1-SIDED SUBMERGED ARC WITH TUBULAR ELECTRODES, CONSUMABLE NOZZLE ELECTROSLAG AND ELECTROGAS WELDING. TESTS INCLUDED CHARPY V, PELLINI DROP WEIGHT, DYNAMIC TEAR AND COD. THE RESULTS MAY BE USED TO PREDICT FLAWED STRUCTURES.

062185
ELECTROSLAG WELDING.
KELLY P F
AUSTRALIAN WELDING JOURNAL VOL. 21, NO. 4. JULY/AUG. 1977. PP. 15-19. 9 FIG., 4 TAB., 6 REF.,
Languages: ENGLISH
ENGLISH PAPER PRESENTED AT: SEMINAR ON HIGH PRODIJCTIVITY CONTINUOUS WIRE WELDING PROCESSES.
THE BASIC PRINCIPLES OF ELECTROSLAG WELDING A(E OUTLINED, AND THREE BASIC TECHNIQUES DESCRIBED. EQUIPMENT, JOINT PREPARATION AND CONSUMABLES ARE DISCUSSED. MECHANICAL PROPERTIES AND THE KIND OF PERFORMANCE THAT CAN BE ,ACHIEVED ARE REVIEWED WITH EXAMPLES FROM THE LITERATURE. FOUR SETS OF WELDING CONDITIONS ARE COMPARED AND APPLICATIONS SUGGESTED.

061428
MECHANICAL PROPERTIES OF CONSUMABLE GUIDE ELECTROSLAG WELD METALS IN GRAIN-REFINED C-MN STEELS.
VEDIA L A DE; PATCHETT B M
WELDING AND METAL FABRICATION VOL. 45. NO: 6, ULY/AUG. 1977. PP. 365-373, 11 FIG.. 5 TAB., 19 REF.,
Languages: ENGLISH
ENGLISH
THE EFFECT OF MANGANESE AND SILICON LEVELS ON THE TOUGHNESS AND TENSILE PROPERTIES OF C-MN MICROALLOYED WELD METALS PRODUCED WITH THE CONSUMABLE GUIDE ELECTROSLAG PROCESS HAS BEEN INVESTIGATED. THE AIM WAS TO DEVELOP GOOD WELD METAL MECHANICAL PROPERTIES IN AL AND NB GRAIN-REFINED STEELS WITHOUT RESORTING TO NORMALIZING. A HIGH-SPEED LOW-HEAT-INPUT TECHNIQUE WITH A BASIC FLUX WAS USED, AND THE WELD METALS WERE TESTED IN THE AS-WELDED AND STRESS-RELIEVED CONDITIONS. THE RESULTS SHOW THAT BS 4360 GRADE 40E (AL ADDTION) AND GRADE 50D(NBADDITION)STEELS REQUIRE DIFFERENT LEVELSMOFMN AND SI IN THEIR RESPECTIVE WELD METALS TO DEVELOP OPTIMUM PROPERTIES.

061386
ELECTROSLAG WELDING OF LARGE CASTINGS FOR SHIP CONSTRUCTION.
BROSHOLEN A; SKAUG E; VESSER J J
WELDING JOURNAL VOL. 56, NO. 8. AUG. 1977. PP. 26-30. 11 FIG., 4 TAB.,
Languages: ENGLISH
ENGLISH
A CMN STEEL PROPELLER SHAFT BRACKET WITH A DIAMETER OF 750MM WAS ELECTROSLAG WELDED USING SIX CONSUMABLE GUIDE ELECTRODES IN 4HR 35 MIN AT 600A, 55V AND AN ELECTRODE FEED-SPEED OF 6.4M/MIN. THE GAP WELDED WAS 38MM AT THE BOTTOM AND 50MM AT THE TOP. WELDING TRIALS, JOINT DESIGN, FIT UP AND PREPARATION, PROCESS APPLICATIONS AND WELD PROPERTIES ARE DESCRIBED. (SEE ALSO: HOBART WELDWORLD NO. AWN-203. 1977.. PP. 16-19.)

060391
MANUFACTURE OF FORKS FOR FORK LIFT TRUCKS,
LANCER BOSS LTD
BRITISH PATENT: I 474 885. FILED: 17 JULY AND 9 OCT. 1973. COMPLETE SPECIFICATION FILED: 21 JUNE 1974. PUBLISHED: 25 MAY 1977. 5 TAB. 11 FIG., 12 CLAIMS. .
Languages: ENGLISH
ENGLISH
L-SHAPED FORK MEMBERS CAN BE WELDED FROM TWO ROLLED-STEEL-STRIPS HELD PERPENDICULAR TO ONE ANOTHER, THE TRO STRIPS BEING CLAMPED IN POSITION AND A WATER-COOLED JACKET ENCLOSING THE JOINT AREA. WELDING IS CARRIED OUT BY FILLING THE SPACE BETWEEN THE STRIPS WITH MOLTEN METAL PROVIDED BY A CONSUMABLE ELECTRODE AND GUIDE WIRES OF EN 24 STEEL. DATA IS GIVEN FOR THE PERFORMANCES OF VARIOUS METAL COMPOSITIONS (INCLUDING MECHANICAL TESTS AND HARDNESS) HEAT-TREATMENT CONDITIONS AND WELDING PARAMETERS (ELECTROSLAG).

057335
THE APPLICATION OF ELECTRICALLY INSULATING COATINGS TO TITANIUM ELECTRODES.
GUREVICH S M
AUTOMATIC WELDING VOL.28, NO.9. SEPT. 1975. P. 61. 1 FIG.,
Languages: ENGLISH
TRANSLATION OF AVTOMATICHESKAYA SVARKA
A METHOD IS DESCRIBED OF PRODUCING A HALIDE COATING ON TITANIUM ELECTRODES USED IN CONSUMABLE GUIDE ELECTROSLAG WELDING OF TITANIUM ALLOYS. AS A RESULT, THE JOINT GAP CAN BE REDUCED, THERE IS NO NEED TO FEED IN FLUX DURING WELDING, WELDING SPEED CAN BE RAISED AND WELD QUALITY IS IMPROVED.

057279
GUIDE FOR STEEL HULL WELDING.
AMERICAN WELDING SOCIETY
STANDARD. AWS D3.5-76. PUBL . MIAMI FL.33125. AMERICAN WELDING SOCIETY 1976. 47 PP. 45 FIG.,
Languages: ENGLISH
THE FIRST SECTION DEALS WITH STEEL MANUFACTURE NOTCH TOUGHNESS AND SPECIFICATIONS FOR STEEL AND WELDING CONSUMABLES. THE SECOND SECTION DEALS WITH WELDING PROCESSES USED IN HULL CONSTRUCTION, NAMELY MMA, SUBMERGED ARC, GMA , FCA, ELECTR05LAG, ELECTROGAS, CONSUMABLE GUIDE, STUD AND THERMIT WELDING. OTHER SECTIONS COVER DESIGN, HULL construction (INCLUDING DISTORTION CONTROL DURING WELDING) AND INSPECTION.

055984
ELECTROSLAG WELDING OF HEAVY SECTIONS.
SCAGNETTI H J: VEDIA L DE: SOLARI M: BILONI H
PAPER PRESENTED AT 29TH ABM ANNUAL CONGRESS PORTO ALEGRE, R.G. DO SUL, BRAZIL. PUBL . SAO PAULO, BRAZIL, ASSOCIACAD BRASILEIRA DE METAIS, 1974. 36 PP. 10 REF.,
Languages: ENGLISH
ENGLISH
ELECTROSLAG WELDS WERE MADE WITH CONSUMABLE GUIDES ON C STEEL PLATES IN THICKNESSES OF 40 AND 65 MM AND ON 150 MM SQUARE BILLETS. THE EFFECTS OF VARIATIONS IN WELDING VOLTAGE, CURRENT INTENSITY AND OSCILLATION OF THE FILLER METAL ON THE SOLIDIFICATION OF THE BEAD, ITS MICRO- AND MACROSTRUCTURES (INCLUDING PENETRATION), THE ANGLE OF INTERSECTION OF THE COLUMNAR GRAINS IN THE WELD METAL AND SEGREGATION SUBSTRUCTURES WERE STUDIED. THE MECHANISM OF METAL TRANSFER FROM THE EDGES OF THE PARENT METAL TO THE POOL OF MOLTEN METAL AND THE INFLUENCE OF PREHEATING OF THE EDGES ON GRAIN GROWTH IN THE PARENT METAL WERE INVESTIGATED. EXPITAXIAL NUCLEATION OF GRAINS SOLIDIFYING IN THE BEAD NAD OTHER STRUCTURAL CHARACTERISTICS TYPICALLY PRODUCED BY WELDING PROCESSES WERE OBSERVED.

055979
VERTICAL WELDING EFFICIENTLY WITH THE CONSUMABLE GUIDE ELECTROSLAG PROCESS.
PATCHETT B M
SME TECHNICAL PAPER AD74-407 DEARBORN, MICH. 48128: SOCIETY OF MANUFACTURING ENGINEERS: 1974. 14 PP. 9 REF.,
Languages: ENGLISH
THE MOST EFFECTIVE ECONOMIC USE OF WELDING REQUIRED CONSIDERATION OF TWO TYPES OF EFFICIENCY: PROCESS EFFICIENCY AND METALLURGICAL EFFICIENCY. A BALANCE BETWEEN THE PROCESS AND METALLURGICAL EFFICIENCIES IS IMPORTANT TO GET THE BEST OVER-ALL EFFICIENCY. METHODS OF ACHIEVING THIS BALANCE FOR THE CONSUMABLE GUIDE ELECTROSLAG PROCESS, USING THE LATEST DEVELOPMENT DATA, ARE DISCUSSED AND RECOMMENDATIONS ON HOW BEST TO USE THE PROCESS FOR STEEL FABRICATIONS ARE GIVEN.

055944
HAWAIIAN STADIUM FLOATS ON AIR.
HOBART WELDWORLD NO. AWN-199. 1975. PP. 16?17. 4 FIG.,
Languages: ENGLISH
A STADIUM HAS BEEN CONSTRUCTED WHICH ADJUSTS ITS SHAPE BY THE MOVEMENT OF FOUR LARGE SECTIONS ON AIR CUSHIONS. THE STRUCTURE WAS WELDED LARGELY USING FLUX CORED ARC WELDING, 'PORTA-SLAG' ELECTROSLAG WELDING AND MMA WELDING. THE STADIUM WAS CONSTRUCTED FROM 11000 SHORT TONS (10000 TONNES) OF WEATHERING STEEL.

055605
FLUX-CORE: GOING STRONG IN SHIPBUILDING,
DEFFERSON T B
WELDING DESIGN AND FABRICATION VOL. 49, NO. 4. APR. 1976. PP. 78-80. 7 FIG.,
Languages: ENGLISH
WELDING INNOVATIONS THAT HAVE SPEEDED UP AND IMPROVED PRODUCTION IN A SHIPYARD ARE DESCRIBED. FABRICATION IS ORGANISED SO THAT AS MUCH WELDING AS POSSIBLE IS DONE IN THE FLAT POSITION, FROM ONE SIDE. THE FLUX-CORED MIG AND SUBMERGED-ARC PROCESSES ARE USED INSTEAD OF MMA WHERE FEASIBLE, AND BACKING TAPES ARE EXTENSIVELY UTILISEO. THE CONSUMABLE GUIDE ELECTROSLAG PROCESS IS USED FOR VERTICAL HULL JOINTS. CORRECTION: IBID. , NO. 6. JUNE 1976. P. 32.

055108
ELECTRO-SLAG WELDING OF LARGE CAPACITY MIXED FLOW HYDRAULIC TURBINE RUNNER.
WELDING INSTITUTE OF THE CHINESE MECHANICAL ENGINEERING SOCIETY PEOPLE'S REPUBLIC OF CHINA, 1975. 12 PP. 11 FIG., 3 TABLES, 1 REF.,
Languages: ENGLISH
ENGLISH
IN ORDER TO IMPROVE PRODUCTIVITY, JOINT QUALITY AND WORKING CONDITIONS, MMA WELDING OF TURBINE COMPONENTS WAS REPLACED BY ELECTROSLAG WELDING. A SPECIAL FIXTURE WAS DESIGNED FOR THE PURPOSE. BY USING CONSUMABLE NOZZLES AND REGULATING HEAT DISTRIBUTION BY CAREFUL POSITIONING OF THE ELECTRODE WIRES IN THE SLAG BATH, PENETRATION DEPTH WAS CONTROLLED THROUGHOUT THE WELD. THE MATERIAL WAS 20MNSI CAST STEEL (0.2 PER CENT C, 1.1 PER CENT MN, 0.7 PER CENT SI). ALSO IN: PROCEEDINGS, ADVANCED WELDING TECHNOLOGY. 2ND INTERNATIONAL SYMPOSIUM OF THE JAPAN WELDING SOCIETY, OSAKA, 25-27 AUGUST 1975. PUBL. TOKYO, JAPAN WELDING SOCIETY, 1975. PP. 651-656.

, 054259
WELDING PROCESSES MOVE TOWARD AUTOMATIC CONTROL.
MULLINS P J
IRON AGE METALWORKING INTERNATIONAL VOL. t4, NO. 10. OCT. 1975. PP. 9-23.,
Languages: ENGLISH
RECENT PROGRESS IN THE VARIOUS CLASSICAL WELDING PROCESSES AND TOWARDS THE SOLUTION OF METALLURGICAL PROBLEMS POSED BY WELDING IS DESCRIBED. TOPICS INCLUDE: DEVELOPMENT OF AUTOMATIC SUBMERGED ARC WELDING, USE OF NUMERICAL CONTROL FOR THE POSITIONING OF THE ELECTRODE, SUPPLY OF ELECTRICAL ENERGY, WIRE FEED, USE OF CORED ELECTRODES FOR MIG WELDING, AND DEVELOPMENT OF CONSUMABLE GUIDE WELDING. USE OF HIGH STRENGTH LOW ALLOY STEELS AND HIGH COOLING RATES IN THE HEAT AFFECTED ZONE HAVE ENCOURAGE INVESTIGATION OF HEAT TREATMENT BEFORE AND AFTER WELDING.

053702
MANUFACTURE OF LOCOMOTIVES AND ROLLING STOCK.
RUFUS W A
AUSTRALIAN WELDING JOURNAL VOL. 19, NO. 4. SEPT./OCT. 1975. PP. 25-27. 8 FIG.,
Languages: ENGLISH
THE WORK OF AN AUSTRALIAN FIRM WHICH CONSTRUCTS RAIL VEHICLES IS OUTLINED. CONSUMABLE NOZZLE AND C02 PROCESSES ARE USED IN CONSTRUCTING SHUNTING AND MAIN LINE LOCOMOTIVES. THE ROLLING STOCK MANUFACTURED INCLUDES TANK CARS, COAL HOPPER WAGONS CATTLE WAGONS AND REFRIGERATED WAGONS. STEELS AND ALUMINIUM ARE THE MAIN MATERIALS USED.

053.307
APPLICATION OF ELECTROSLAG WELDING TO HEAVY COMPONENTS.
UUIIE A SATO S SAKAI S: HAMANAKA A
ADVANCED WELDING TECHNOLOGY:PROCEEDINGS 2ND INTERNATIONAL SYMPOSIUM OF THE JAPAN WELDING SOCIETY,0SAKA,25-27 AUGUST 1975, JAPAN WELDING SOCIETY, 1975.VOL.11.PAPER 2-4-(8).PP.534-5-47.tl FIG.,2 REF.,
Languages: ENGLISH
OPTIMUM CONDITIONS FOR CONSUMABLE GUIDE WELDING ARE DISCUSSED.ELECTROSLAG WELDED JOINTS ARE USUALLY NORMALISEOD TOELIMINATE BRITTLENESS IN THE HAZ.BUT MODIFICATION OF WELDING PROCEDURE AND CHEMICAL COMPOSITION CAN ELIMINATE THE NEED FOR NORMALIZING.

053306
FABRICATED STEEL STRUCTURE OF LARGE-CAPACITY WELDED HYDRAULIC TURBINE RUNNER.
SEJIMA I KITA H ROKUTANI T; WADA T
ADOVANCED WELDING TECHNOLOGY ;PROCEEDS 2ND INTERNATIONAL SYMPOSIUM OF THE JAPAN WELDING SOCIETY' 0SAKA,25-27 AUGUST 1975.JAPAN WELDING SOCIETY, 1975.VO.11.PAPER 2-4-(7).PP.537-54-2.10 FIG.,4 TABLES,9 REF.,
Languages: ENGLISH
CONSUMABLE NOZZLE WELDING WAS USED TO CONSTRUCT TURBINE RUNNERS. THE RUNNER IS A ROTATING BODY WHICH WILL OPERATE AT LOW TEMPERATURES SO IT WAS SUBLEECTED TO POST-WELD HEAT TREAMENT.VARIOUS TYPES OF CRACKING WERE ENCOUNTERED WHERE ELCT?OSLAG-WELDING WAS USED.WAYS OF PREVENTING CRACKS ARE OUTLINED. THE STEELS USED WERE S--4IC(C-MN)AND SC-46(C-MN-NI-C-R-CU).

053303
PROBLEMS AND IMPROVEMENT OF LARGE HEAT INPUT ELECTROSLAG WELDING,
WATANABE K
ADVANCED WELDING TECHNOLOGY PROCEEDINGS 2ND INTERNATIONAL SYMPOSIUMOF THE JAPAN WELDING SOCIETY,OSAKA, 25-27 AUGUST 1975 JAPAN WELDING SOCIETY, 1975.VOL.11.PAPER 2-4-(4).PP.519-5-24.14 FIG.,7 REF.,
Languages: ENGLISH
THE MOST EFFECTIVE METHODS FOR DECREASING HEAT INPUT IN ELECTROSLAG WELDING ARE TO REDUCE THE WELD GAP AND THE VOLUME OF METAL DEPOSITED. EXPERIMENTS WERE CARRIED OUT ON NARROW GAP ELECTROSLAG WELDING USING A 0.8. MM X 20 MM STRIP ELECTROOE AND A CONSUMABLE GUIDE.THE GAP COULD BE REDUCED TO ABOUT 12 MM WITH A CORRESPONDING REDUCTION IN HEAT INPUT. MECHANICAL PROPERTIES , PARTICULARLY RESISTANCE TO HOT CRACKING AND BRITTLENESS, IMPROVED.

053302
NARROW GAP ELECTROSLAG WELDING PROCESS.
ITO Y IKEDA M YAMAUCHI N: FURUICHI J
ADVANCED WELDING TECHNOLOGY;PROCEEOINGS 2ND INTERNATIONAL SYMPOSIUM OF THE JAPAN WELDING SOCIETY,DSAKA.25-27 AUGUST 1975.JAPAN WELDING SOCIETY, 1975.VOL.II.PAPER 2-4-(3).PP.513-5-18.13 FIG.,6 TABLES. ,
Languages: ENGLISH
(ALSO IN:JAPAN SHIPBUILDING AND MARINE ENGINEERING,VOL.8.NO-.3. 1974.PP.28-33).
INSTEAD OF THE USUAL WIRE ELECTRODE AND CIRCULAR NOZZLE.THE NARROW-GAP PROCESS EMPLOYS A 'HOOP' STRIP ELECTRODE OF RECTANGULAR SECTION AND THICKNESS 1 MM,GUIDED BY A RECTANGULAR NOZZLE.THE EFFECT OF THE HOOP ELECTRODE IS THAT,DESPITE THE JOINT GAP BEING REOUCED,THE SLAG BATH REMAINS EVENLY HEATED OVER THE PLATE THICKNESS AND DEFECTS SUCH AS POOR PENETRATION ARE AVOIDED. APART FROM THE ELECTRODE FEED UNIT,CONVENTIONAL CONSUMABLE-NOZZLE WELDING EQUIPMENT IS USED.OETAILS ARE GIVEN OF THE ELECTRODE COMPOSITION AND DIMENSION,ANO OF THE WELDING CONDITIONS EMPLOYED, TOGETHER WITH TEST RESULTS SHOWING THE PROPERTIES OF THE WELDED JOINT.SEE ALSO:SUMITOMO SEARCH, NO.14.NOV. 1975.PP.69-74.

053292
AUTOMATIC WELDING APPARATUS OF SIDE LONGITUDINALS OF SUPERTANKER HULL AT ERECTION STAGE.
ONISHI T; FURUTA S; OZAKI A
ADVANCED WELDING TECHNOLOGY: PROCEEDINGS 2ND INTERNATIONAL SYMPOSIUM OF THE JAPAN WELDING SOCIETY, OSAKA , 25-27 AUGUST 1975. JAPAN WELDING SOCIETY, 1975. VOL.II.PAPER 2-2-(28) PP.445-448.11 FIG., 2 TABLES, 1 REF.,
Languages: ENGLISH
THE LONGITUDINAL ASSEMBLIES CONSIST OF WEB AND FACE PLATES. ONE-SIDED AUTOMATIC C02 WELDING WITH AN OSCILLATING ELECTRODE IS USED FOR THE WEB L-JOINTS. CONSUMABLE GUIDE WELDING IS USED FOR THE FACE JOINTS. A SPECIAL MOBILE UNIT HAS BEEN CONSTRUCTED FOR FITTING UP AND WELDING THE JOINTS. THE UNIT TRAVELS UP AND DOWN THE LONGITUDINAL AND INCLUDES A JIG FOR JOINT MISALIGNMENT CORRECTION.

052908
FIXED-DAM,VERTICAL-UP,OPEN ARC WELDING.
LINCOLN ELECTRIC CO
BRITISH PATENT 1 411 042.FILED:6 SEPT. 1973. (USA 287 813 11 SEPT. 1972) .PUBLISHED:22 OCT. 1975.3 FIG.6 CLAIMS. ,
Languages: ENGLISH
THIS METHOD USES A CONSUMABLE NOZZLE AND ELECTRODE BUT MAINTAINS LIMITED DEPTH OF SLAG SO THAT AN OPEN ARC EXISTS THROUGH THE SLAG TO THE WELD POOL.THIS GIVES INCREASkD WELDING SPEED COMPARED WITH CONVENTIONAL ELECTROSLAG WELDING.THE CONSUMABLE ELECTRODE HAS A TUBULAR MILD STEEL SHEATH AND A CORE CONTAINING NAISIF6 OR K2SIF6.

052902
CONSUMABLE GUIDE NOZZLE FOR USE IN ELECTROSLAG WELDING.
GREAT CANADIAN OIL SANDS LTD
BRITISH PATENT 1 410 --0 . .IED:2 MARCH 1973(USA 6 . 1972) .PUBLISHED:2 20C T.75.3 FIG: 4 CLAIMS. ,
Languages: ENGLISH
A CONSUMABLE GUIDE NOZZLE CONSISTS OF A COATED STEEL OR OTHER METAL TUBE WHICH PROVIDES A HARD FACING WELD METAL. THE COATING CONSISTS OF METALLIC CARBIDE PARTICLES BLENDED WITH OTHER METAL COMPONENTS. FOR CORNER SURFACING, THE CONSUMABLE NOZZLE MAY HAVE A 90-DEGREE ANGLED CROSS -SECTION. "

052529
THE NATURE OF DISTORTION IN THE ELECTROSLAG WELDING OF LARGE BANDS OF ROASTING FURNACES.
SEMENOY V M
WELDING PRODUCTION VOL. 22, NO.1. JAN 1975. PP. 35-37. 2 FIG. , 1 TABLE, 3 REF.,
Languages: ENGLISH
TRANSLATION OF SVAROCHNOE PROIZVODSTVO
DEFORMATIONS DUE TO THE CONSUMABLE GUIDE ELECTROSLAG WELDING OF HALF-RINGS FOR FURNACES, OF DIAMETER ABOUT 8 M, CROSS SECTION 560 X 1380 MM, WERE MEASURED AND FOUND TO BE SIMILAR TO THOSE IN THE WELDING OF LARGE RECTANGULAR PROOUCTS (11-14 MM). THIS IS ATRIBUTED TO ASYMMETRIC HEATING. REQUIRED TOLERANCES CAN BE ACHIEVED BY THE METERED COUNTERACTION METHOD, IN WHICH THE HALF-RINGS ARE BENT, BEFORE WELDING, BY AN AMOUNT EQUAL TO THAT OF THE EXPECTED DEFORMATION. DISTORATION ARISING DURING MACHINING AND TRANSPORT CAN ALSO BE COMPENSATE FOR.

052392
ELECTROSLAG WELDING OF T JOINTS WITH SINGLE V EDGE PREPARATION USING A TUBULAR CONSUMABLE GUIDE.
SUSHCHUK-SLYUSARENKO I I
AUTOMATIC WELDING VOL.28, NO. 1.JAN.1975.P.53.3 FIG., 1 REF.
Languages: ENGLISH
TRANSLATION OF AVTOMATICHESKAYA SVARKA
DETAILS ARE GIVEN OF THE SIMPLIFICATION OF THE PROCESS OF ELECTROSLAG WELDING WITH A CONSUMABLE TUBULAR GUIDE OF PRESS COMPONENTS OF THICKNESS 80 MM,LENGTH 2.5 M. A THICK-WALLED GUIDE TUBE OF EXTERNAL DIAMETER 14 MM WITH A WELDED-ON LONGITUDINAL RIB, AND A WATER-COOLED COPPER BACKING PLATE WERE USED. AN EXAMPLE IS GIVEN OF THE MACROSTRUCTURE OF A FILLET WELD WITH V-SHAPE EDGE PREPARATION. STEEL PLATES CAN ALSO BE USED FOR WELD SHAPING, IN ADDITION TO THE COPPER PLATE.

051706
ELECTROSLAG WELDING WITH A CONSUMABLE GUIDE PLATE ANd FIBERISED FLUX.
STARK L E
DVS BERICHTE NO.32. PROCEEDINGS, 2ND INTERNATIONAL COLLOQUIUM ON WELDING IN NUCLEAR ENGINEERING, DUSSELDORF, 23-24 OCT. 1974.PUBL.DUSSELDORF ,OVS, t974.PP.155-159. 7 FIG.,3 TABLES. ,
Languages: ENGLISH
ENGLISH
A NEWLY DEVELOPED PROCESS IS DESCRIBED WITH DETAILS OF THE APPARATUS USED. THE DEVELOPMENT INCLUDED WELDING TESTS USING BARE CONSUMABLE GUIDE PLATES, PREPARATION OF THE FIBERISED FLUX AND TESTS CARRIED OUT WITH THE FLUX. THESE TESTS CONSISTED OF TENSILE AND IMPACT STRENGTH DETERMINATIONS AFTER STRESS RELIEVING. IT WAS FOUND THAT FOR THICKNESSES OVER 100 MM THE NEW PROCESS IS MANY TIMES FASTER THAN SUBMERGED ARC OR CONVENTIONAL ELECTROSLAG WELDING. RECOMMENDATIONS FOR FUTURE DEVELOPMENT ARE PRESENTED BRIEFLY.

051554
APPARATUS FOR WELDING VERTICAL JOINTS.
ESAB LTD
BRITISH PATENT 1 400 384. FILED: 20 MAY 1974 (SWEDEN 73071/70 22 MAY 1973). PUBLISHED: 16 JULY 1975. 2 FIG. 5 CLAIMS. ,
Languages: ENGLISH
THIS EQUIPMENT FOR SONSUMABLE GUIDE WELDING CONSISTS OF A CONSUMABLE TUBULAR GUIDE MEMBER WITH AN EXTERNAL SCREW THREAD: A UNIT FOR FEEDING THE ELECTRODE THROUGH THE CONSUMABLE GUIDE; MEANS FOR SUPPORTING AND POSITIONING THE CONSUMABLE GUIDE WITHIN THE WELDING GAP CONSISTING OF AN ANNULAR MEMBER MOUNTED FOR ROTATION IN A UNIT: WELD POOL RETAINING MEANS.

051485
CRACK OPENING DISPLACEMENT TESTING OF WELD METAL AND THE INFLUENCE OF THE ROTATION AXIS ON THE TEST RESULTS.
RIETJENS P H A
DELFT UNIVERSITY OF TECHNOLOGY DEPARTMENT OF WELDING TECHNOLOGY REPORT 09-2/26. AUG. 1973. 33 PP.15 FIG.,3 TABLES, 11 REF.,
Languages: ENGLISH
ENGLISH
A DESCRIPTION IS GIVEN OF THE POSSIBILITY OF DEFINING CODS BY SO-CALLED DOUBLE MEASUREMENT CARRIED OUT ON COMPACT KIC AND BEND SPECIMENS OF WELDED JOINTS. THIS METHOD SHOWS THAT OVER A VERY IMPORTANT RANGE OF CRACK OPENING DISPLACEMENT (COD) VALUES CONSIDERABLE ERRORS ARE MADE BY ASSUMING THE SPECIMEN TO HAVE A FIXED CENTRE OF ROTATION, AS IS USUAL IN THE PROPOSED STANDARD COD TEST PROCEDURE. COMPARISON OF TEST RESULTS OF BOTH SPECIMENS (CK AND BEND) SUGGESTS THAT THE USE OF BEND SPECIMENS GIVES MORE CERTAINTY ABOUT THE PRECISION OF THE TEST RESULTS. FINALLY, THE RESULTS OF COO TESTS OF STATIC-LOADED BEND AND COMPACT KIC SPECIMENS,JiIBLINK DROP-WEIGHT TESTS AND CHARPY-V IMPACT TESTS APPLIED TO THE DEPOSITED METAL OF ELECTROSLAG WELDED PLATES (THiCKNESS 50MM.ST52NB) ARE PRESENTED.

051383
RECENT EXPERIENCES IN AUTOMATIC ARC WELDING.
HORSFIELD A M
SVETSAREN NO. 1.1975.PP. t-9. 12 FIG., 3 REF.,
Languages: ENGLISH
DEVELOPMENTS ARE CONSIDERED IN THE FOLLOWING FIELDS: GRAVITY WELDING WITH COATED ELECTRODES: C02 WELDING WITH FLUX CORED ELECTRODES: SUBMERGED ARC WELDING: ELECTROSLAG AND CONSUMABLE GUIDE WELDING.

051228
METHOD OF HARDFACING METAL WORKPIECE.
GREAT CANADIAN OIL SANDS LTD
BRITISH PATENT 1 398 500. FILED: 28 MARCH 4973. (USA 239 071 29 MARCH 1972). PUBLISHED: 25 JUNE 1975. 6 FIG., ' 4 CLAIMS. ,
Languages: ENGLISH
THIS IS A METHOD OF HARDFACING BY ELECTROSLAG WELDING USING AT LEAST TWO SEPARATE CONSUMABLE GUIDE NOZZLES OF A DIFFERENT METALLURGICAL COMPOSITION. THE WORKPIECE CAN BE A BUCKET WHEEL OR EXCAVATOR TOOTH. ONE GUIDE MEMBER MAY CONTAIN 60 PER CENT TUNGSTEN CARBIDE, 30 PER CENT FERROCHROME, 5 PER CENT FERROMOLYBDENUM AND 5 PER CENT FERROVANADIUM, AND THE OTHER MAY CONTAIN 49 PER CENT FERROCHROME, 49 PER CENT SILICON CARBIDE AND 2 PER CENT COBALT.

051187
CONSUMABLE GUIDE ELECTROSLAG WELDING OFFERS DESIGN FLEXIBILITY.
WELDING NEWS NO. 157. NOV. 1974. PP. 9-11. 6 FIG., 1 TABLE.

Languages: ENGLISH
THE COMPLEX WELDING OF TWO SECTIONS OF A RAILWAY STATION USING AS A186 MILD AND C-MN STEELS IS DESCRIBED. OVER 100 WELDS WERE MADE AND ULTRASONICALLY EXAMINED. DETAILS ARE GIVEN OF THE EQUIPMENT AND CONSUMABLES (NOZZLE GUIDES, SHOES ETC.), AND THE WELDING CONDITIONS AND TIMES ARE TABULATED.

051162
CONSUMABLE NOZZLE ELECTROSLAG WELDING.
MOZOS A DE LOS
ROTACION VOL. 7, NO. 78. 1975. PP. 9-18. 15 FIG.,
Languages: SPANISH
SPANISH
A DESCRIPTION IS GIVEN OF TESTS CARRIED OUT FOR THE APPLICATION IN PRODUCTION OF CONSUMABLE-NOZZLE ELECTROSLAG WELDING EQUIPMENT DESIGNED TO WELD LONGITUDINAL BUTTS FOR BOTTOMS AND DECKS OF TANKERS. DATA ON THE EQUIPENT USED TOGETHER WITH NOZZLE AND FLUX COMPOSITIONS AND TESTS UNDERTAKEN FOR APPROVAL BY THE CLASSIFYING BODIES ARE INCLUDED. BUTTS OF 600 X 35 AND 660 X 24 MM AND LENGTHS OF 575 X 36 MM ARE CURRENTLY WELDED. THE FLOW DIAGRAM AND OPERATIONAL TECHNIQUES ARE SHOWN.

050867
MICROCRAKCS IN CONSUMABLE GUIDE WELDS AND THEIR POSSIBLE CONSEQUENCES ON WELD PERFORMANCE.
BANKS E E; RITCHIE J
AUSTRALIAN WELDING JOURNAL VOL. 19, NO. 1. JAN./FEB. 1975. PP. 7-10. 5 FIG., 3 TABLES, 5 REF.,
Languages: ENGLISH
FACTORS CAUSING MICROCRACKING 'IN CONSUMABLE GUIDE WELDING 'ARE MOISTURE IN THE WELD POOL, FLUX DEPTH, VOLTAGE AND RESTRAINT LEVEL. TESTS WERE CARRIED OUT ON WELDS IN ASA 186 GRADE 250 PLATE (C 0.17 PER CENT MN 0.8 PER CENT, S 0.015 PER CENT, PO.014 PER CENT). PRESENCE OR ABSENCE OF MICROCRACKS WAS JUDGED BY SIDE-BEND TESTS. IT IS CONCLUDED THAT IN PRACTICE MICROCRACKS ARE DIFFICULT TO DETECT BY NOT METHODS, BUT THE CONSEQUENCES OF MICROCRACKING ARE NOT SERIOUS.

050764
POWER SOURCES FOR GAS AND SLAG SHIELDED ARC WELDING PROCESSES.
PINFOLD B E; JUBB J E M
PART 3: POWER SOURCE SELECTION. WELDING TECHNOLOGY DATA SHEET NO. 49. WELDING AND METAL FABRICATION VOL. 43, NO. 4. MAY 1975. PP. 274-276. 7 FIG.,
Languages: ENGLISH
PART 2:IBID. , NO. 3. APR. 1975. PP. 179- 180:WELDASEARCH 5-0478.
ELECTRICAL CHARACTERISTICS OF POWER SOURCES FOR MIG AND ELECTROSLAG/CONSUMABLE GUIDE WELDING SYSTEMS ARE DISCUSSED.

050414
TECHNIQUES FOR CARRYING OUT ELECTROSLAG WELDING.
SUSHCHUK-SLYUSARENK0 I I; LYCHKO I I
BOOK PUBLISHED KIEV,NAUKOVA DUMKA, 1974.95 PP.26 REF.,
Languages: RUSSIAN
RUSSIAN
THIS MANUAL GIVES THE TECHNOLOGICAL PRINCIPLES OF ELECTROSLAG WELDING AND SURGACING OF STRUCTURAL STEELS AND LOW AND MEDIUM ALLOY STEELS. INCLUDING MULTIPLE ELECTRODE WELDING WITH CONSUMABLE GUIDE AND WITH ELECTRODES OF LARGE CROSS SECTION, COMPLETION OF LINEAR AND CIRCUMFERENTIAL JOINTS, AND EQUIPMENT USED.

050395
ELECTROSLAG CASTING AND WELDING.
CLARKE-CHAPMAN LTD
BRITISH PATENT 1 390 674. FILED: 4 MARCH 1972. COMPLETE SPECIFICATION FILED: 9 FEB. 1973. PUBLISHED: 16 APRIL 1,975. FIG. 12 CLAIMS.,
Languages: ENGLISH
THE METHOD IS SPECIALLY APPLICABLE TO THE WELDING OF NOZZLES ONTO PRESSURE VESSELS. A WATER COOLED COPPER MOULD IS PLACEO AROUND THE CIRCULAR OPENING ON THE PRESSURE VESSEL PLATE. WIRES EQUISPACED ROUND THE MOULD CAVITY ARE FED THROUGH CONSUMABLE GUIDES AND MELTED INTO THE MOULD. THE CIRCULAR NOZZLE IS THUS CAST AROUND THE OPENING IN THE PLATE. THE MOLTEN METAL IN THE MOULD FORMS A WELDED JOINT WITH THE PRESSURE VESSEL PLATE.

050359
THE RELATIVE ECONOMIES IN APPLICATION OF SUBMERGED ARC, (CONSUMABLE NOZZLE) ELECTROSLAG AND FLUX CORED WIRE PROCESSES.
KELLY P F
AUSTRALIAN WELDING JOURNAL VOL. 18, NO. 5. SEPT.-OCT. 1974. PP. 111-118. 11 FIG., 10 TABLES, 3 REF.,
Languages: ENGLISH
PAPER NO. 10 FOR 1ST AUSTRALASIAN WELDING CONVENTION, AUCKLAND, NEW ZEALAND. 14-17 OCT. 1974.
DETAILS ARE GIVEN OF THE CHARACTERISTICS, PRINCIPLES, EQUIPMENT, CONSUMABLES, MECHANICAL PROPERTIES AND DISTORTION OF WELDS, DEPOSITION RATE, SPEED AND OPERATOR SKILLS REQUIRED FOR FLUX CORED ARC WELDING (WITH OR WITHOUT ADDITIONAL C02 SHIELDING), SUBMERGED ARC WELDING AND ITS VARIANTS (TANDEM, TWIN ARC, MULTIHEAD), AND CONSUMABLE NOZZLE ELECTROSLAG WELDING. EXAMPLES ARE GIVEN OF ECONOMIC COMPARISONS BETWEEN THE PROCESSES.

050358
THE APPLICATION OF CONTINUOUS WIRE PROCESSES TO THE FABRICATION OF STRUCTURAL MEMBERS.
WRIGHT M W
AUSTRALIAN WELDING JOURNAL VOL. 18. NO. 5. SEPT.-OCT. 1974. PP. 101-108. 17 FIG., 1 TABLE.,
Languages: ENGLISH
PAPER NO. 9. FOR 1ST AUSTRALASIAN WELDING CONVENTION, AUCKLAND, NEW ZEALAND, 14-17 OCT. 1974.
CONSIDERATION IS GIVEN TO WELDING FLANGES TO WEBS OR GIRDERS, BUTT WELDING OF GIRDERS, WELDING ON OF STIFFENERS, ETC., AND FUTURE DEVELOPMENTS. SUBMERGED ARC WELDING IS THE MAIN PROCESS DISCUSSED, BUT CONSUMABLE NOZZLE ELECTROSLAG, MIG, SELF-SHIELDED FLUX CORED ARC WELDING AND MANUAL METAL ARC WELDING ARE ALSO DEALT WITH. THE CHARACTERISTICS OF THE PROCESSES, THE PROCEDURES USED AND PRODUCTIVITY ATTAINED ARE DETAILED.

046925
CALCULATION OF THE PARAMETERS OF THE SHAPE OF PENETRATION IN ELECTROSLAG WELDING WITH A CONSUMABLE GUIDE.
EREGIN, L P
WELDING PRODUCTION VOL. 21, NO. 4. APRIL 1974. PP. 45-48. 4 FIG., 1 TABLE, 2 REF.,
Languages: ENGLISH
TRANSLATION OF SVAROCHNOE PROIZVODSTVO.
DIFFICULTIES ARE ENCOUNTERED IN ACHIEVING UNIFORM PENETRATION OF THE EDGES IN ELECTROSLAG WELDING WITH A CONSUMABLE GUIDE. THE WELD SHAPE DEPENDS ONT EH INTER-ELECTRODE DISTANCE, THE GUIDE THICKNESS, THE GAP BETWEEN THE EDGES, AND ON THERMAL POWER IN WELDING. A METHOD OF CALCULATING THE PENETRATION SHAPE WAS DEVELOPED. AT CONSTANT GAP, ELECTRODE FEED RATE AND GUIDE THICKNESS IMPROVED UNIFORMITY OF PENETRATION CAN BE OBTAINED BY REDUCTION OF THE INTERELECTRODE DISTANCE AND INCREASE IN THE VOLTAGE. THE PENETRATION SHAPE, AS CALCULATED BY THE PROPOSED METHOD, IS SIMILAR TO THAT 0BTAINED EXPERIMENTALLY.

045767
SOME ASPECTS OF THE USE OF HIGH STRENGTH STEELS IN OIL TANKERS.
AZPIROZ J J
REVISTA DE SOLDADURA VOL.4,No. 1.JAN-MAR. 1974. .PP.3-15.14 FIG.,2 TABLES,7 REF.,
Languages: SPANISH
SPANISH
DESIGN CONSIDERATIONS ARE OUTLINEO,AND DETAILS ARE GIVEN OF MANUAL METAL ARC WELDING USING LOW HYDROGEN ELECTRODES, SEMIAUTOMATIC FLUX-CORED C02 WELDING, SUBMERGED ARC WELDING,CONSUMABLE GUIDE ELECTROSLAG WELDING,CORROSION TESTS AND ECONOMIC ANALYSIS.COVERAGE IS LIMITED TO STEELS OF 360 MPA UTS,MICROALLOYEO WITH NB AND NORMALISED.

045360
MICRO-CRACKING IN CONSUMABLE-NOZZLE ELECTROSLAG WELD METAL.
KUNIHIRO T; NAKAJIMA H
PROCEEDINGS OF SEMINAR "SIGNIFICANCE OF DEFECTS IN WELDED STRUCTURES" TOKYO 15-19 OCT. 1973. PUBLISHED UNIV. OF TOKYO PRESS 1974. 12BN 0-86008-114-1. PP. 105-109. 8 FIG., 2 TABLES, 2 REF; SESSION DISCUSSION, PP. 118-124. ,
Languages: ENGLISH
MICROCRACKS PRODUCED IN SPECIAL CONDITIONS IN CONSUMABLE GUIDE WELD METAL IN HT50 STEEL ARE HYDROGEN INDUCED CRACKS WHICH CAN BE PREVENTED BY INCREASING THE DEPTH OF THE SLAG PoOL AND DECREASING THE COOLING RATE OF THE WELD METAL. THE EFFECT OF THESE MICORCRACKS ON THE FATIGUE STRENGTH OF WELDED J0INTS WAS INVESTIGATED. IF THE WELD REINFORCEMENT IS LEFT ON THE FATIGUE STRENGTH DEPENDS ON THE STRESS CONCENTRATION AT THE WELD TOES WITH OR WITHOUT MICROCRACKS. IF THE WELDS ARE GROUND FLUSH MICROCRACKS REDUCE FATIGUE STRENGTH.

044772
DEVELOPMENT AND APPLICATION OF AUTOMATIC PROCESSES.
WILSON A
AUSTRALIAN WELDING JOURNAL VOL. 18, NO. 2. MAR. -APR. 1974. PP. 8-15, 10 FIG., 1 TABLE, 11 REF.,
Languages: ENGLISH
PAPER PRESENTED AT 21ST ANNUAL WELDING CONFERENCE, SYDNEY, AUSTRALIA, OCT. 1973.
THE ADVANTAGES AND DISADVANTAGES OF AUTOMATIC WELDING PROCESSES ARE OUTLINED. GAS METAL ARC WELDING IS REVIEWED, PARTICULARLY THE GAS MIXTURES THAT ARE CURRENTLY IN USE. AUTOMATIC PROCESSES FOR PIPELINE AND RAIL WELDING ARE DISCUSSED, AND RECENT DEVELOPMENTS IN CONSUMABLE GUIDE AND ELCTROSLAG WELDING DESCRIBED.

044605
THE STRUCTURE AND PROPERTIES OF WELD METALS FOR HY 80 QUENCHED AND TEMPERED STEELS.
APPS R L; SMITH E
PROCEEDINGS INTERNATIONAL SYMPOSIUM, 'WELDABILITY OF HEIGHTENED AND HIGH STRENGTH METALS', ZAGREB, YUGOSLAVIA. 22-23 MAY 1974, ORGANISED BY SERBIAN SOCIETY FOR ADVANCEMENT OF WELDING. PUBL. BELGRADE, YUGOSLAVIA. ASSOCIATION OF YUGOSLAV WELDING SOCIETIES. 1974. PAPER NO. 12. PP. 163-176. 9 FIG., 7 TABLES, 10 REF.,
Languages: ENGLISH, CROATIAN
ENGLISH SERBOCROAT
SUBMERGED ARC, MANUAL METAL ARC, METAL INERT GAS AND CONSUMABLE GUIDE WELDS IN HY80 STEEL WERE PREPARED USING COMMERCIALLY AVAILABLE CONSUMABLES. THE MECHANICAL PROPERTIES OF LOW DILUTION DEPOSITS WERE EVALUATED USING HARDNESS, TENSILE, AND NOTCH-IMPACT TESTS, AND THE RESULTS HAVE BEEN RELATED TO WELD METAL COMPOSITION AND MICRO-STRUCTURE. THE INFLUENCE OF POST-WELD HEAT TREATMENT ON THE WELD DEPOSITS WAS ALSO STUDIED. THE MECHANICAL PROPERTIES OF THE WELD DEPOSITS ARE ADEQUATE FOR APPLICATIONS DOWN TO -20 DEG.C BUT NOTCH TOUGHNESS IS NOT EQUIVALENT TO THAT OF PARENT MATERIAL. THERE IS A POSSIBILITY THAT ATTENTION TO WELD METAL MICROSTRCUTURE AND INCLUSION CONTENT COULD IMPROVE THIS SITUATION.

044350
CONSUMABLE NOZZLE TYPE ELECTROSLAG WELDING PROCESS USING FLUX CORED WIRE (SES PROCESS USING FLUX-CORED WIRE).
NIPPON STEEL CORPORATION
NEW WELDING PROCESS.PUBL.SAGAMIHARA JAPAN. NIPPON STEEL CORP. NIPPON STEEL WELDING PRODUCTS AND ENGINEERING CO.LTD.PAPER NO. 13.PP. I05-108. 1 FIG.,2 TABLES. ,
Languages: ENGLISH
THE PROCESS IS IDENTICAL WITH THE SES PROCESS WITH COVERED CONSUMABLE GUIDE (WELDASEARCH 4-4349) EXCEPT THAT A CORED FILLER WIRE IS USED. SIMILAR EQUIPMENT IS USED WITH A DIFFERENT WIRE FEED ROLLER. STANDARD WELDING CONDITIONS ARE GIVEN FOR PLATE BETWEEN 12 AND 50 MM THICK. WELD METAL TENSILE AND IMPACT PROPERTIES ARE GIVEN FOR A RANGE OF STEELS USED IN SHIPBUILDING. SEE ALSO:NIPPON STEEL TECHNICAL REPORT (OVERSEAS), NO.6.1974.PP. 40-48. (IN ENGL.ISH).

044349
ELECTRIC SLAG WELDING PROCESS WITH COVERED CONSUMABLE NOZZLE ('SES WELDING PROCESS').
NIPPON STEEL CORPORATION
'NEW WELDING PROCESS' .PUBL.SAGAMIHARA JAPAN.NIPPON STEEL CORP.NIPPON STEEL WELDING PRODUCTS AND ENGINEERING CO LTD.PAPER NO 12.PP.99-104.4 FIG.,3 TABLES.,
Languages: ENGLISH
THIS SLIGHTLY MODIFIED CONSUMABLE GUIDE PROCESS USES A FLUX-COVERED STEEL TUBE AS A CONSUMABLE NOZZLE.DETAILS ARE GIVEN OF EQFIPMENT,CONTROL DEVICES,TYPES OF GUIDE FOR STEELS OF DIFFERENT STRENGTH AND THICKNESS.STANDARD WELDING CONDITIONS ARE GIVEN FOR PLATE FROM 14-60 MM THICNNESS.

043694
BLAST FURNACE CONSTRUCTION GOES ELECTROSLAG.
DAOLINI N A.
CANADIAN WELDER AND FABRICATOR VOL. 65, NO. 1. JAN. 1974. PP. 10-11. 4 FIG.,
Languages: ENGLISH
CONSUMABLE GUIDE ELECTROSLAG WELDING ENSURED HIGH QUALITY WELDS IN BLAST FURNACE JACKETS AND WAS ALSO ECONOMICAL AND SPEEDY, ALTHOUGH POSITIONING DIFFICULTIES CAUSED DELAYS. ONE JACKET WAS CONICAL, 14.25 FT (4.3 M) HIGH, 41-43.5 FT (12.5-13.3 M) IN DIAMETER. THE OTHER WAS CYLINDRICAL, 22 FT (6.7 M) HIGH. 41 FT (12.5 M) IN DIAMETER. CONSTRUCTION INVOLVED 9-22 FT (2.7-6.7M) LONG SHOP AND FIELD WELDS IN 1.5 IN. (38 MM) THICK MATERIAL.

043330
HIGH SPEED CONSUMABLE GUIDE WELDING OF RELATIVELY THIN STEEL PLATE.
HASLAM A; APPS R L; PATCHETT B M
PROCEEDINGS OF THE THIRD INTERNATIONAL CONFERENCE 'ADVANCES IN WELDING PROCESSES' HARROGATE 7-9 MAY 1974. PUBL. ABINGTON CAMBRIDGE, U.K. THE WELDING INSTITUTE. 1974. PAPER NO. 8. PP. 47-58. 11 FIG., 6 TABLES, 11 REF.,
Languages: ENGLISH
A TECHNIQUE HAS BEEN DEVELOPED FOR WELDING PLATES OF LESS THAN 25 MM IN THICKNESS AT HIGH SPEEDS AND LOW HEAT INPUTS USING THE CONSUMABLE GUIDE ELECTROSLAG WELDING PROCESS. WELDING SPEEDS OF THE ORDER OF 10 M/H AND HEAT INPUTS BELOW 20 KL/MM ARE READILY ATTAINABLE IN WELDS UP TO 2 M IN LENGTH. THE TECHNIQUE RELIES ON NARROW WELDING GAPS AND HIGH DEPOSITION RATES (CURRENTS) TO ACHIEVE HIGH WELDING SPEEDS. A SIMPLE METHOD OF ELECTRICAL INSULATION WHICH SIMULTANEOUSLY CONTROLS DIMENSIONAL STABILITY IN THE WELDING GAP HAS BEEN DEVELDPED, AS HAS AN EMPIRICAL METHOD OF CALCULATING THE MAXIMUM CURRENT-CARRYING CAPACITY OF CONSUMABLE GUIDES TO AVOID FAILURE THROUGH OVERHEATING. WELDING SPEEDS AND HEAT INPUTS CAN BE PREDICTED WITHIN NARROW LIMITS FOR SPECIFIED WELDING CONDITIONS IN PLATES BETWEEN 12 AND 25 MM IN THICKNESS. GOOD WELDS HAVE BEEN OBTAINED IN BS 4360, 'GRADE 43A STEEL.

043073
CROSS COUNTRY TRIP FOR ELECTROSLAG WELDING.
WELDING JOURNAL VOL.53 NO 1 JAN 1974 P.28.2 FIG.,
Languages: ENGLISH
4 IN. (102 MM) THICK, 10 FT. (3 M) LONG PLATES OF COR-TEN B FOR A U.S.WEST COAST NUCLEAR INSTALLATION WERE SHIPPED TO PITTSBURGH, PA.,FOR THE EXECUTION BY A SPECIALISED FABRICATOR USING CONSUMABLE NOZZLE ELECTROSLAG WELDING OF 24 IN.(0.61 M) BLIND WELDS ALONG A 10 FT.(3 M) HEIGHT AND 48 IN.(1.22 M) BLIND WELDS ALONG A 4 FT.(1.22 M) HEIGHT. SATISFACTORY WELDS WERE PRODUCED IN A QUARTER OF THE TIME REQUIRED FOR CONVENTIONAL PROCESSES.

042921
WELDING IN JAPANESE SHIPYARDS.
NORTH T H
WELDING AND METAL FABRICATION VOL. 42, NO. 4. APRIL 1974. PP. 118-124. 11 FIG., 1 TABLE, 5 REF.,
Languages: ENGLISH
NEW ASSEMBLY METHODS HAVE BEEN DEVELOPEO AND WORKING CONDITIONS lMPROVED TO ATTRACT MORE WELDERS. THE TREND TOWARDS MACHINE-INTENSIVE WELDING IS DESCRIBED IN RELATION TO SUBMERGED ARC WELDING OF FLAT PANELS, USING FLUX-BACKING CONSUMABLES, AND OF STIFFENERS BY GRAVITY WELDING METHODS, C02 WELDING, GMA MECHANISED WELDING OF BLOCK ASSEMBLIES, AND ELECTROGAS, ELECTROSLAG AND CONSUMABLE NOZZLE ELECTROSLAG WELDING.

042901
THE ELECTROSLAG WELDING OF HEAVY SECTION 25KHN3MF STEEL.
CHERNYKH V V
AUTOMATIC WELDING VOL. 26, NO. 6. JUNE 1973. PP. 71-72. 1 REF.,
Languages: ENGLISH
TRANSLATION OF AVTOMATICHESKAYA SVARKA
A BRIEF DESCRIPTION IS GIVEN OF THE ELECTROSLAG WELDING OF A FULL SCALE MODEL FOR LOW ALLOY STEEL TURBOGENERATOR ROTORS. THE WELD CROSS-SECTION WAS 2000 X 2650 MM. CONSUMABLE GUIDE WELDING WAS USED, WITH A PREHEAT OF 450 DEG. C. THE COMPLETED ITEM, WEIGHING 160 TONNES, WAS NORMALISED AND TEMPERED AFTER WELDING. A BAR WAS REMOVED FROM THE CENTRE OF THE WELD, AND TENSILE AND IMPACT TESTS AND METALLOGRAPHIC EXAMINATION WERE CARRIED OUT, THE RESULTS OBTAINED BEING CONSIDERED SATISFACTORY.

042782
ARC WELDING IN SPANISH SHIPYARDS.
PENCHE C.
HOBART WELDWORLD NO. AWN-195. 1973. PP. 20-22. 5 FIG..
Languages: ENGLISH
THE USE OF MANUAL MIG SUBMERGED ARC, MINIATURE ELECTROSLAG AND CONSUMABLE GUIDE WELDING IN SPANISH SHIPYARDS IS DESCRIBED. SPANISH SHIP PRODUCTION EXPANDED FOUR TIMES FASTER THAN THE AVERAGE DURING THE LATE 1960S AND A MARKED TREND TOWARDS MECHANISATION OF WELDING ACCOMPANIED THIS GROWTH.

042763
STRUCTURAL STEELWORK FOR (THE SYDNEY, AUSTRALIA) KINGS CROSS AND MARTIN PLACE RAILWAY STATIONS.
BILSTON K J M.
AUSTRALIAN WELDING JOURNAL VOL. 17. NO. 5. SEPT.-OCT. 1973. PP. 31-33. 4 FIG., 4 REF.,
Languages: ENGLISH
PAPER NO. 2 PRESENTED TO 21ST NATIoNAL WELDING CONFERENCE, AUSTRALIAN WELDING INSTITUTE, SYDNEY, N.S.W., 8-12 OCT. 1973.
LARGE CONTINUOUS BEAMS SUPPORTED ON COLUMNS WERE REOUIRED FOR PERMANENT SUPPORT IN TWO UNDERGROUNO RAILWAY STATIONS IN SYDNEY'S EASTERN SUBURBS RAILWAY. THE DESIGN, FABRICATION, WELDING AND ERECTION OF THE STEEL WORK ARE DISCUSSED. THE CONSUMABLE GUIDE ELECTROSLAG, FLUX-CORED C02 AND SUBMERGED ARC WELDING PROCESSES WERE USED.

042634
NEW TECHNOLOGY FOR MANUFACTURING THE BEARING UNIT OF A ROTARY KILN.
KOZULIN M G.
WELDING PRODUCTION VOL. 20, NO. 5. MAY 1973. PP. 77-78. 2 FIG., 1 TABLE, 2 REF.,
Languages: ENGLISH
TRANSLATION OF SVAROCHNOE PROIZVODSTVO.
THE BEARINGS CONSIST OF SHELLS AND HOOPS, HITHERTO SECURED USING GASKETS AND SIDE STOPS. TWO HALVES, EACH OF 35T, STEEL 35L (0.37 PER CENT C:0.69 PER CENT MN:0.25 PER CENT CR) WERE JOINED BY CONSUMABLE TIP ELECTROSLAG WELDING. METHODS FOR COMPENSATING FOR STRAIN TO ACHIEVE DIMENSIONAL ACCURACY. ARE REPORTED. AFTER LOCAL STRESS RELIEVING AND ULTRASONIC TESTING OF THE WELDS, THE BEARING UNITS WERE COMPLETED BY CIRCUMFERENTIAL SUBMERGED ARC WELDING, WITH PREHEATING, STRESS RELIEVING AND ULTRASONIC INSPECTION. THE UNITS HAVE PROVED ENTIRELY SATISFACTORY OVER TWO YEARS' SERVICE.

042602
WELDED FABRICATION OF HEAVY COMPLEX STRUCTURAL UNITS.
AMBROSE S A; PENNIE J.
AUSTRALIAN WELDING JOURNAL VOL. 17, NO. 4. JULY-AUG. 1973. PP. 11-14. 9 FIG., 1 TABLE.,
Languages: ENGLISH
THE FABRICATION OF COMPLEX STRUCTURAL UNITS IN AS A186 GRADE 250 MILD STEEL OF UP TO 7 IN (180 MM) THICKNESS IS DESCR1IED. INVERTED TRIANGULAR UNITS OF BOX GIRDERS WERE REQIRED FOR THE BASE SECTIONS OF A 20 STOREY BUILDING TO BE BUILT OVER A RAILWAY STATION. THESE UNITS WERE FABRICATED USING MANUAL METAL ARC, FLUX CORED GASLESS, SUBMERGED ARC AND CONSUMABLE GUIDE ELECTROSLAG WELDING PROCESSES. DETAILS OF THE WELDING PARAMETERS AND TECHNIQUES ARE GIVEN.

042579
USE OF A TUBULAR CONSUMABLE GUIDE FOR ELECTROSLAG WELDING METAL, UP TO 50MM THICK.
SUSHCHUK SLYUSARENKO I I
AUTOMATIC WELDING VOL.26.N0.5.MAY 1973.PP.73-74.2 FIG.,3 REF. ,
Languages: ENGLISH
(TRANSLATION OF AVTOMATICHESKAYA SVARKA).
IT HAS BEEN FOUND POSSIBLE TO USE CONSUMABLE GUIDE ELECTROSLAG WELDING FOR MATERIALS AS THIN AS 25-50MM.THE SPECIAL NARROW GUIDE TUBE DEVELOPEd,AND USE OF THE PROCESS FOR FABRICATION OF A 125 T PRESS FRAME.ARE DESCRIBED.

042481
UNUSUAL ELECTROSLAG WELDING APPLICATIONS.
DORSCHU K E NORCROSS J E; GAGE,C;C
WELDING JOURNAL VOL.52,NO.11.NOV.1973.PP .710-716.16 FIG.,8 TABLES. ,
Languages: ENGLISH
THE ADVANTAGES OF ELECTROSLAG WELDING(OF BOTH THE MOVING SHOE AND CONSUMABLE NOZZLE VARIETIES)INCLUDE HIGH DEPOSITION RATE,EFFICIENCY AND WELD METAL SOUNDNESS,COST SAVINGS WHEN JOINING THICK PLATE OR ASSEMBLING MASSIVE COMPONENTS,AND LOW DISTORTION IN SUITABLE CASES.PREOFITABLE USE OF THE PROCESS IS ILLUSTRATED BY APPLICATIONS INCLUDING:THE WELDING OF SIDE GRAMES IN 1020 STEEL FOR A 5000-TON HYDRAULIC PRESS;THE FABRICATION OF GAINT HOOPS USED IN PRESSES THAT FORM SYNTHETIC DIAMONDS:THE WELDING OF NUCLEAR TIE DOWNS:THE REPAIR OF A CRACKED CEMENT KILN RING AND A BROKEN STEEL MILL ROLL:THE OVERLAYING OF 1060 STEEL ON LOCOMOTIVE DRIVE WHEELS:THE ELECTROSLAG CASTING OF A 2 1/4 CR-IMO STEEL PRESSURE VESSEL:AND THE SURFACING OF HIGH-ALLOY AND TOOL STEEL BILLETS WITH MILD STEEL ON THE ENDS FOR SMOOTHER HOT ROLLING.

042409
ELEGTROSLAG AND ELECTROGAS WELDING,
ANDERSEN C B
SVEISETEKNIKK VOL.28.N0.4.SEPT. 1973.PP. 61-67.70-72.18 FIG.,2 TABLES,10 REF..
Languages: DANISH
DANISH
THE PRINCIPLESMACHINES USED,APPLICATIONS AND PROSPECTS ARE DESCRIBED FOR THE MECHANISED VERTICAL WELDING PROCESSES-ELECTROSLAG, CONSUMABLE GUIDE ELECTROSLAG,AND ELECT@-OGAS WELDING.THE PROCESSES ARE COMPARED.A SHORT SURVEY IS GIVEN OF WELD STRUCTURE.MECHANICAL PROPERTIES AND DEFECTS,AND THE ECONOMICS OF THE PROCESSES.

042394
NON-DESTRUCTIVE EXAMINATION OF WELDS AS APPLIED IN HEAVY STEEL FABRICATION AT AUSTRALIAN IRON AND STEEL PTY. LTD., PORT KEMBLA.
RICHARDS K R
TESTING INSTRUMENTS AND CONTROLS, VOL. NO. NO. 9. SEPT. 1973. PP. 9-14. 10 FIG. PAPER PRESENTED AT SYMPOSIUM ON "NON-DESTRUCTIVE EXAMINATION OF WELDS", 1973.,
Languages: ENGLISH
THE FABRICATION OF A STEEL SHOP INVOLVED THE ULTRASONIC INSPECTION OF THICK-SECTION WELDS IN STRUCTURAL STEEL PRODUCED BY AUTOMATIC PROCESSES, INCLUDING CONSUMABLE GUIDE ELECTROSLAG WELDING. THIS INSPECTION METHOD WAS USED BECAUSE IT GAVE GREATER COVERERY INSPECTION, AND HAS THE REQUIRED SENSITIVITY.
WELD DEFECTS ARE DESCRIBED, WHICH OCCURRED IN T JOINTS, BUTT WELDS WITH VARIOUS JOINT SHAPES, INCLUDING LAMELLER TEARING AND LACK OF FUS1ON. THE EXAMINATION OF HOT METAL AND TEEMING LADLES, MADE OF STEEL PLATE, HOT METAL AND TEEMING LADLE TRANSFER CARS, AND OVERHEAD CRANES AND RUNWAY GIRDERS IS DESCRIBED IN WHICH CRACKING AND OTHER DEFECTS WERE FOUND.

042355
THE ELECTROSLAG WELDING OF BANDS FOR A 7 X 230 M ROTARY CEMENT KILN.
KOZULIN M G: MAKAROV G N; SUSHCHUK SLYUSARANKO I I
AUTOMATIC WELDING VOL. 26, NO. 4. APR. 1973. PP. 7D7i. 2 FIG. , 1 TABLE, 2 REF.,
Languages: ENGLISH
TRANSLATION OF AVTOMATICHESKAYA SVARKA.
THE WELDING CROSS SECTION OF THE 130 T FURNACE, , OF TYPE 30 STEEL, " 0.5 X 1.35 M. HALF-RINGS MADE FROM TWO PARTS WERE CONSUMABLE GUIDE ELECTROSLAG WELDED TOGETHER ON SITE. ACCURACY OF SHAPE OF THE COMPLETED FURNACE BANDS WAS SATISFACTORY.

042142
CONFERENCE - WELDING LOW-TEMPERATURE CONTAINMENT PLANT.
METAL CONSTRUCTION AND BRITISH WELDING JOURNAL VOL. 6, NO. 1. JAN. 1974. PP. 18-21.,
Languages: ENGLISH
A REPORT ON THE AUTUMN CONFERENCE OF THE WELDING INSTITUTE, HELD IN LONDON, IN NOVEMBER, 1973. THE PAPERS PRESENTED ARE BRIEFLY DESCRIBED UNDER THE FIVE CONFERENCE SESSION HEADINGS: CONSUMABLES FOR NICKEL STEELS, INCLUDING WELD-METAL STRENGTH AND FERRITIC CONSUMABLES: FRACTURE TOUGHNESS OF NICKEL STEELS; OTHER CRYOGENIC MATERIALS, FOR SUBMERGED-ARC AND CONSUMABLE-GUIDE WELDING, FATIGUE, ELECTROSLAG WELDING OF ALUMINIUM, lNVAR ALLOYS: DESIGN AND CONSTRUCTION RELATING TO WELDED TUBE, SPHERICAL TANKS, PIPELINES AND TANK ROOFS, WITH REFERENCE TO QUALITY CONTROL: CODES OF PRACTICE FOR STORAGE TANKS .

041858
METHOD FOR VERTICAL WELDING OF ALUMINIUM.
UNION CARBIDE CORPORATION
BRITISH PATENT 1 343 499. FILED 20 MAY 1971. (UNITED STATES OF AMERICA 39425. FILED 21 MAY 1970). PUBLISHED 9 JAN. 1974. 1 FIG. 8 CLAIMS.,
Languages: ENGLISH
THE INVENTION PROVIDES A METHOD FOR VERTICAL WELDING ALUMINIUM OR ALUMINIUM ALLOY WORKPIECES HAVING A THICKNESS OF AT LEAST 1IN. (25MM) TO OVERCOME THE DIFFICULTIES ENCOUNTERED WITH THE USUAL TYPE OF ELECTROSLAG PROCESS. . AN ALUMINIUM OR ALUMINIUM ALLOY WIRE ELECTRODE IS PASSED THROUGH A CURRENT-CARRYING GUIDE TUBE INTO A CAVITY BETWEEN THE WORKPIECE SURFACES, AND A PAIR OF OPPOSITELY DISPOSED WELD PUDDLE RETAINERS MADE OF GRAPHITE, OR FACED WITH GRAPHITE, ARE POSITIONED SO THAT THE WIRE ELECTRODE IS PROGRESSIVELY FUSED WITHIN THE CAVITY UNDER A LAYER OF HALOGEN BASE FLUX WHICH IS MAINTAINED MOLTEN BY THE PASSAGE OF A WELDING CURRENT OF FROM 1300 TO 400 AMPERES AT 40 TO 75 VOLTS. WHEN WELDING PLATES OF THICKNESS GREATER THAN 21N. (5CM) SEVERAL GUIDE TUBES MUST BE USED , EACH SUPPLIED WITH WIRE PASSED THROUGH A ROTATING SKEWER.

041730
ELECTRO-SLAG WELDING OF ALUMINIUM.
POTTHOFF F: KIESSLING L; BECKEN O
PREPRINTS CONFERENCE ON WELDING LOW TEMPERATURE CONTAINMENT PLANT, LONDON, 20-22 NOVEMBER 1973, PUBL. ABINGTON, CAMBRIDGE. THE WELDING INSTITUTE. 1973. PAPER NO. 16. PP. 140-148. 7 FIG. , 7 TABLES, 11 REF.,
Languages: ENGLISH
ELECTROSLAG WELDNG OF ALUMINIUM HAS BEEN DEMONSTRATED TO THE POSSIBLE. DETAILS ARE GIVEN OF CONSUMABLE GUIDE ELECTROSLAG WELDING PROCEDURES AND FLUX COMPOSITIONS. HIGIH WELDING SPEEDS (95MM/MIN) cAN BE ACHIEVED. STRENGTH OF WELD METAL IN AL: 5 PER CENT MG ALLOY CORRESPONDS TO THAT OF THE PARENT PLATE. POROSITY, INCLUSIONS AND LACK OF FUSION CAN BE AVOIDED. IN GERMAN IN: SCHWEISSEN UND SCHNEIDEN, VOL. 25, NO. 10. OCT. 1973. PP. 470-472.

041728
HIGH SPEED ONSUMABLE GUIDE WELDING OF C-MN STEELS FOR LOW TEMPERATURE CONTAINER APPLICATIONS.
PATCHETT B M; COLLINS F W; APPS R L
PREPRINTS CONFERENCE ON WELDING LOW TEMPERATURE CONTAINMENT PLANT, LONDON, 20-22 NOVEMBER 1973, PUBL. ABINGTON, CAMBRIDGE. THE WELDING INSTITUTE. 1973. PAPER NO. 14. PP. 117-129. 7 FIG.. 3 TABLES, 14 REF.,
Languages: ENGLISH
WELDING SPEEDS OF 10M/HR AND HEAT INPUTS OF LESS THAN 15KJ/MM IN 19MM THICK PLATE HAVE BEEN PRODUCED USING A NARROW GAP CONSUMABLE GUIDE TECHNIQUE. SATISFACTORY PROPERTIES HAVE BEEN ACHIEVED IN SEVERAL BS 4360 WELD METALS IN THE AS-WELDED CONDITION. PEARLITE-REDUCED AND PEARLITE FREE STEELS GIVE GOOD WELD METAL PROPERTIES WITH ADEQUATE PARENT PLATE AND HAZ PROPERTIES, MAKING THESE STEELS SUITABLE FOR SUBZERO APPLICATIONS. WELDS WERE MADE IN A MODIFIED X-65 STEEL USING A VARIETY OF FILLER WIRES TO DETERMINE OPTIMUM PROCESS CONDITIONS AND WELD METAL COMPOSITION.

041660
APPLICATION OF ELECTRO-SLAG AND CONSUMABLE GUIDE WELDING, PART 6.
ELLIS D J: GIFFORD A F
WELDING AND METAL FABRICATION VOL. 41, NO, 11. NOVEMBER 1973. PP. 387-390, 9 FIG.,
Languages: ENGLISH
PARTS 1-5: IBID., NOS. 4,5,6,8,10, APR., MAY, JUNE , AUG. , OCT. 1973., PP. 112-119, 116-166, 198-203, 284-287 AND 326-364, RESPECTIVELY.
IN THIS, THE CONCLUDING ARTICLE OF A SERIES, THE APPLICATIONS OF ELECTRO-SLAG AND CONSUMABLE GUIDE WELDING DESCRIBED ARE THE WELDING OF SHIPS STERN FRAMES, THE WELDING OF OIL DRILLING RIG LEGS, MINE SHAFT LININGS AND FLANGES FOR WIND TUNNELS.

041358
CONSUMABLE GUIDE ELECTROSLAG WELDING OF VERTICAL BEAM JOINTS .
ANDERSEN N -E
SVETSAREN NO. 1. 1973. PP. 9-12. 5 FIG., 1 TABLE.,
Languages: ENGLISH
NEW EQUIPMENT FOR CONSUMABLE GUIDE WELDING IS DESCRIBED. THE PRINCIPLES OF THE PROCESS ARE COMPARED WITH THOSE OF NORMAL ELECTROSLAG AND THE IMPORTANCE OF CORRECT FLUX COMPOSITION IS STRESSED. ALSO BRIEFLY DESCRIBED ARE THE MECHANICAL PROPERTIES ATTAINED IN TYPICAL WELDMENTS.

041252
WELDING OF CASTINGS.
FWP JOURNAL VOL. 13, NO. 7. JULY 1973. P.Il. 1 FIG.,
Languages: ENGLISH
A DEMONSTRATION OF A SIX WIRE CONSUMABLE GUIDE APPARATUS FOR WELDING VERY LARGE CASTINGS IS DESCRIBED. THE APPARATUS HAS SUCCESSFULLY JOINED TWO CASTINGS TO PRODUCE A ROLLIN MILL STAND WEIGHING 94TONS . ULTRASONIC TESTING SHOWED A DEFECT-FREE (JOINT.

041108
ELECTROSLAG WELDING WITH A CONSUMABLE GUIDE.
KELLY P F
AUSTRALIAN WELDING JOURNAL VOL. 16, NO. 7. NOV-DEC. 1972. PP. 13-17, 23. 11 FIG., 2 TABLES, 3 REF.,
Languages: ENGLISH '~
AN OUTLINE IS GIVEN OF THE PRINCIPLE AND OPERATION OF THE CONSUMABLE GUIDE PROCESS AND OF POWER SOURCE AND ANCILLARY EQUIPMENT REQUIREMENTS. THE NECESSITY FOR ADEQUATE DEOXIDANTS IN THE WIRE IS POINTED OUT. DIMENSIONAL REQUIREMENTS OF THE EDGE PREPARATION AND GAP SIZE ARE GIVEN, TOGETHER WITH THE PROCEDURE FOR STARTING A WELD AND SETTING CONDITIONS. ATTENTION IS PAID TO JOINT DESIGN AND DISTORTION. THE MECHANICAL PROPERTIES OF THE WELD METAL AND HAZ ARE DESCRIBED, AND MENTION IS MADE OF POSSIBLE LOSS OF TOUGHNESS DUE TO HAZ GRAIN COARSENING. EXAMPLES ARE GIVEN OF TYPICAL APPLICATIONS OF THE PROCESS, ASSOCIATED COSTS BEING COMPARED WITH THE USE OF SUBMERGED ARC WELDING.

040577
ELECTROSLAG WELDING.
GUYOT F
REVUE DE LA SOUDURE/LASTIJDSCHRIFT VOL. 29, NO. 1. 1973. PP. 17-26. 9 FIG.,
Languages: FRENCH
FRENCH
ELECTROSLAG AND ELECTROGAS WELDING APPLICATIONS HAVE DEVELOPED GREATLY OVER THE LAST TEN YEARS. GENERALLY, THE TECHNICAL AND ELECTRICAL CHARACTERISTICS ARE WELL KNOWN. AFTER A SHORT DESCRIPTION OF THE DIFFERENT APPLICATIONS. A MORE DETAILED STUDY IS GIVEN OF THE MECHANICAL PROPERTIES OF THE WELDED JOINT. SOME ECONOMIC ASPECTS OF THE PROCEDURES. AND THE PRESENT SITUATION IN BELGIUM OF ELECTROGAS AND ELECTROSLAG WELDING ARE CONSIDERED.

040503
THE USE OF CONSUMABLE NOZZLE ELECTROSLAG WELDING IN THE SHIPBUILDING INDUSTRY.
KALAGO M; PIOTROWSKI F: KOBIEROSWKI A
PRZEGALD SPAWALNICTWA VOL. 25, NO. 5. MAY 1973. PP. 104-106. 5 FIG., 1 TABLE, 4 REF.,
Languages: POLISH
POLISH
THE METHOD AND THE EQUIPMENT AND MATERIALS USED ARE DESCRIBED. THE EQUIPMENT IS SIMPLE, OF LOW WEIGHT. TECHNOLOGY OF THE WELDED JOINTS. CONSUMABLE NOZZLE ELECTROSLAG WELDING IS TO BE USED ABOVE ALL IN FABRICATION OF STRUCTURES, IN PARTICULAR WHEN A LARGE NUMBER OF JOINTS OF UP TO IM LENGTH IS MADE IN THE VERTICAL POSITION. POSSIBLE APPLICATIONS OF THE PROCESS.

040355
APPLICATION OF ELECTRO-SLAG AND CONSUMABLE GUIDE WELDING.
ELLIS D J; GIFFORD A F
PART 4. WELDING AND METAL FABRICATION VOL. 41, NO. 8. AUG. 1973. PP. 284-287. 11 FIG.,
Languages: ENGLISH
HEAVY STEEL MILL ROLLING EQUIPMENT, PRESSES AND STEEL CONVERTERS ARE THE COMPONENTS COVERED IN THIS PART OF THE REVIEW ON ELECTRO-SLAG AND CONSUMABLE GUIDE WELDING. DETAILS ARE GIVEN OF THE TECHNIQUES USED AND THE DEGREES OF DISTORTION TO BE EXPECTED.

038257
PROCESS PARAMETERS AND MECHANICAL PROPERTIES OF HIGH SPEED CONSUMABLE GUIDE WELDS.
PATCHETT B M: COLLINS F W; APPS R L
WELDING AND METAL FABRICATION VOL. 41, NO. 6. JUNE 1973. PP. 216-224. 20 FIGS., 5 TABLES, 16 REFS.,
Languages: ENGLISH
THE EFFECT OF WELDING GAP DIMENSION AND METAL DEPOSITION RATE ON WELDING SPEEDS AND HEAT INPUTS HAS BEEN INVESTIGATED. WELDING SPEEDS OF UP TO 15 M/H WITH HEAT INPUTS OF LESS THAN 20KJ/MM WERE MADE IN 32-38 MM THICK MILD STEEL PLATES USING WELDING GAPS BETWEEN 10 MM AND 19 MM WITH INSULATED CONSUMABLE GUIDES. THE HIGH SPEED LOW HEAT INPUT CONDITIONS WERE APPLIED TO WELDING BS 4360 STEELS USING ACID AND BASIC COMMERCIAL FLUXES , AND THE MECHANICAL PROPERTIES OF THE WELDED JOINTS WERE EXAMINED. IN THE AS-WELDED CONDITION, THE TENSILE PROPERTIES OF THE WELD METALS WERE ABOVE SPECIFICATION, BUT THE IMPACT PROPERTIES OF THE WELD METALS MET THE PLATE SPECIFICATION ONLY WHEN BASIC FLUXES WERE USED. THE CHAMICAL COMPOSITION OF THE STEEL WAS THE D0MINANT FACTOR AFFECTING IMPACT PROPERTIES IN THE HEAT-AFFECTED ZONE. IN THE AL GRAIN REFINED GRADE 40E STEEL, IMPACT VALUES IN LOW HEAT INPUT WELDS WERE SATISFACTORY, AS THEY WERE IN THE SEMI-KILLED GRADE 40D STEEL. THE FULLY-KILLED NB GRAIN REFINED GRADE 50D STEEL YIELDED IMPACT VALUES WELL BELOW SPECIFICATION EVEN WITH LOW HEAT INPUTS.

038254
APPLICATION OF ELECTROSLAG AND CONSUMABLE GUIDE WELDING. PART 3.
ELLIS D J: GIFFORD A F
WELDING AND METAL FABRICATION VOL. 41, NO. 6. JUNE 1973. PP. 198-203. 17 FIGS.,
Languages: ENGLISH
FURTHER APPLICATIONS OF THE PROCESSES IN THE CONSTRUCTION OF POWER GENERATION EQUIPMENT ARE DESCRIBED. IN PARTICULAR, CONSIDERATION IS GOVEN TO THE DESIGN OF MACHINES AND SHOES AND TO THE WELDING PROCEDURES FOR MAKING T BUTT JOINTS. SHRINKAGE, BOWING AND ANGULAR DISTORTION CAN OCCUR IN T BUTT JOINTS; PREVENTIVE MEASURES ARE OUTLINED.

037743
APPLICATION OF ELECTROSLAG AND CONSUMABLE GUIDE WELDING.
ELLIS D J; GIFFORD A F
PART 2. WELDING AND METAL FABRICATION VOL. 41, NO. 5. MAY 1973. P.P. 161-166. 16 FIG.,
Languages: ENGLISH
JOINT PREPARATION AND WELDING PROCEDURES FOR SOME APPLICATIONS OF THE PROCESSES IN THE CONSTRUCTION OF NUCLEAR POWER STATIONS ARE DESCRIBED. THESE ARE : CONSUMABLE GUIDE WELDING OF 4 IN. (102 MM) BS 1501/161/C SILICON KILLED CARBON STEEL PLATES TO FORM A SHIELDING FOME: ELECTROSLAG WELDING OF 0.75 IN (19.1 MM) BS 1501/161.C PLATES TO PRODUCE A CORE RESTRAINT CYLINDER; FABRICATION OF STEAM RAISING UNIT SHELLS FROM PLATE OF THICKNESS 2.94 IN. TO 3.75 IN. (74 TO 98 MM) LONGITUDINAL WELDS IN 5.5 IN. (140 MM) THICK C:MN STEEL CHARGE TUBES . AND THE FABRICATION OF C02 INLET NOZZLES FROM THREE MILD STEEL FORGINGS OF 14 IN. (355 MM) THICKNESS.

037386
WELDING PROCESSES FOR MODERN PRESSURE VESSEL FABRICATION.
SANTILHANO P D.
SYMPOSIUM ON MODERN FABRICATION PRX:EDURES FOR PRESSURE VESSELS AND BOILERS (WELDING TECHNOLOGY COURSE NO. 9) HELD BY SOUTH AFRICAN INSTITUTE OF WELDING, 7-8 NOV. 1972. ED.: C.E. MAVROCODATOS. PUBL.: BRAAMFONTEIN, TRANSVAAL. SOUTH AFRICAN INSTITUTE OF WELDING. 1972. PAPER 4. 38 PP. 15 FIG., 5 TABLES, 4 REF.,
Languages: ENGLISH
THE AUTHOR BRIEFLY DESCRIBES THE PRINCIPLES AND APPLICATION OF MANUAL METAL ARC, C02, FLUX CORED GASLESS, MIG, TUNGSTEN ARC, SUBMERGED ARC AND ELECTROSLAG WELDING TO MILD. LOW ALLOY AND STAINLESS STEELS. TYPES OF CONSUMABLES AND OPERATING CHARACTERISTICS ARE OUTLINED FOR EACH PROCESS. AN EXAMPLE IS GIVEN ON PROCESS SELECTION, NDT, AND SUBSEQUENT HEAT TREATMENT WHEN WELDING A THICK WALLED PRESSURE VESSE'L.

037327
APPLICATION OF ELECTROSLAG AND CONSUMABLE GUIDE WELDING (PART 1).
ELLIS D J; GIFFORD A F.
WELDIHO AND METAL FABRICATION VOL. 4), NO. 4. APRIL 1973. PP.)12-)19. 18 FIG. ,
Languages: ENGLISH
ELECTROSLAG WELDING OF PRESSURE VFSSEL? IS DISCUSSED. CONSIDERATION IS GIVEN TO THICKNESS RANGE, NUMBER OF SEAMS, JOINT PREPARA¢ION, VFSSFL SIZE AND SFAM LFNGTH, CHOICF OF EQUIPMENT, WELDING CONDITIONS. DISTORTION AND HEAT TRFA>MENT FOR BOTH LONGITUDINAL AND CIRCUMFERENTIAL SEAMS. CYLINDRICAL AND COWICAL VESSELS ARF DFALT WITH.

037286
RECENT DEVELOPMENTS IN WELDING STEEL CASTINGS.
RIDAL E J; JACKSON W J
PROCEEDINGS OF 17 ANNUAL CONFERENCE 'METALLURGICAL PROCESSES AFFECTING THE QUALITY OF STEEL CASTINGS', HARROGATE, 28-29 OCT. 1971. SHEFFIELD, STEEL CASTINGS RESEARCH AND TRADE ASSOCIATION, 1971. PAPER 12, 18 PP. 25 FIGS.,4 TABLES, 19 REFS. , 2 APPENDICES. DISCUSSION: PP.24-29. ,
Languages: ENGLISH
PART 1 PUBLISHED IN METAL CONSTRUCTION AND BRITISH WELDING JOURNAL, VOL.4, NO.11. NOV. 1972. PP.413-417.
THIS PAPER HAS THREE DISTINCT SECTIONS. THE FIRST DESCRIBES AN INVESTIGATION INTO THE EFFECTS OF SULPHUR CONTENT (FROM 0.004 PER CENT - 0.039 PER CENT), OF LOW HYDROGEN AND RUTILE ELECTRODES, OF CARBON EQUIVALENT FROM 0.2 TO 0.46, AND OF RESIDUAL ELEMENTS (NI MAX.OF 0.16 PER CENT, CR MAX.OF 0.20 PER CENT AND MO MAX.OF 0.09 PER CENT) ON THE WELDABILITY OF CAST C:MN STEELS. CTS TESTS AT T.S.N.S OF 15,10,7 AND 5 WITH NO PREHEATING WERE USED . SUCESSFUL WELDS WITH NO HAZ CRACKING RESULTED; RESIDUAL ELEMENTS DID NOT IMPAIR THE WELDABILITY WHICH WAS SUPERIOR TO THAT REPORTED PREVIOUSLY FOR WROUGHT C:MN STEEL. IN THE SECOND PART, THE ADVANTAGES OF CAST-WELD FABRICATION ARE DELINEATED; SEVERAL EXAMPLES ARE ILLUSTRATED. IN THE FINAL PART, SOME OF THE NEWER SEMIAUTOMATIC CONSUMABLE WIRE WELDING PROCESSES APPLICABLE TO STEEL CASTINGS ARE DISCUSSED. THESE ARE C02 WELDING WITH SOLID AND FLUX CORED WIRE, SELF SHIELDED WELDING AND CONSUMABLE GUIDE WELDING.

036873
MARTIN PLACE RAILWAY STATION - PART IV,
WELDING NEWS NO. 148, APRIL 1972. PP. 8-9. 4 FIG., 1 TABLE.

Languages: ENGLISH
PARTS 1-3 APPEARED IN WELDING NEWS, NOS. 144, 146 AND 147 RESPECTIVELY.
THE ARTICLE DESCRIBES THE SITE WELDING OF STEEL BEAM WEBS INVOLVING BUTT WELDS IN 100 MM (4 IN.) THICK MATERIAL USING THE CONSUMABLE GUIDE ELECTROSLAG PROCESS. WELDING CONDITIONS ARE TABULATED, NO PREHEAT BEING USED, AND 1450 MM (57 IN.) LENGTHS BEING WELDED IN 6-1/2 HRS WELD TIME. FINAL 1DO PER CENT ULTRASONIC INFECTION WAS CARRIED OUT.

036872
WELDED 52 TON GIRDER TABLE.
WELDING NEWS NO. 148. APRIL 1972. PP. 2-8. 8 FIG.,
Languages: ENGLISH
FABRICATED IN STEEL, THE TABLE INVOLVED BUTT WELDS IN 280 MM (11 IN.) WEB PLATES AND 180 MM (7 IN.) BASE PLATES, FOLLOWED BY A T-BUTT WELD BETWEEN THE WEB AND THE BASE. AND T-BUTT WELDS TO ATTACH 150 MM (6 IN.) AND 100 MM (4 IN.)THICK GUSSETS. CONSUMABLE GUIDE ELECTROSLAG WELDING WAS USED FOR BOTH THE BUTT AND THE T-BUTT WELDS. DETAILS OF WELDING CONDITIONS AND WELD TIMES ARE TABULATED. NORMALIZING WAS CARRIED OUT AT BETWEEN 860 DEG.C AND 900 DEG.C WITH 100 PER CENT ULTRASONIC EXAMINATION BEFORE AND AFTER HEAT TREATMENT. SUBSEQUENT MACHINING REMOVED ABOUT 4 TONNES OF METAL, THE TABLE FINALLY BEING OF ABOUT 49 TONNES (48 TONS).

036662
IMPROVEMENTS IN ELECTROSLAG WELDING.
BRITISH STEEL CORPORATION
BRITISH PATENT 1 303 794. FILED: 3 FEB. 1970. COMPLETE SPECIFICATION FILED: 19 APRIL 1971. PUBLISHED: 17 JAN. 1973. 3 FIG. 12 CLAIMS. ,
Languages: ENGLISH
IN CONSUMABLE GUIDE WELDING, A TROUGH ISLOCATED BENEATH THE WORKPIECES AND BRIDGES THE WHOLE WIDTH AND LENGTH OF THE BOTTOM OF THE WELD GAP. SLAG IS PLACED IN THE TROUGH AND HEATED BY INDUCTION OR RESISTANCE HEATING TO FACILITATE WELD STARTING. SLAG MAY BE INTRODUCED EITHER MOLTEN OR AS A DRY POWDER. AND THE WORKPIECES ARE PREFERABLY PREHEATED. BOTH RESISTANCE AND INDUCTION HEATED TROUGHS ARE DESCRIBED. FOR NON-RECTANGULAR WORKPIECES, ADAPTOR CHECKS ARE WELDED OVER THE WORKPIECE ENDS AND THE TROUGH PLACED BENEATH THE CHECKS.

036318
INVESTIGATION OF A DEFECT IN A CONSUMABLE-GUIDE WELD.
MUSGRAVE M P; ELLIS D J
METAL CONSTRUCTION AND BRITISH WELDING JOURNAL VOL. 5, NO. 1. JAN. 1973. PP. 26-27. 3 FIG.,
Languages: ENGLISH
PIPING THROUGH THE WELD METAL WAS DISCOVEREO WHEN A CRUCIFORM JOINT BETWEEN FOUR PLATES, THOUGHT TO BE OF BS 1501-224-GR. 32 MATERIAL, WAS SECTIONED. INVESTIGATION SHOWED THAT TWO OF THE PLATES WERE OF A LOW-CARBON, LOW-SILICON TYPE OF NO PARTICULAR SPECIFICATION. THESE PLATES, BEING UNKILLED, RELEASED GAS INTO THE MOLTEN POOL, THUS CAUSING PIPING.

036041
THE DESIGN AND PERFORMANCE OF A HIGH-SPEED CONSUMABLE-GUIDE ELECTROSLAG WELDING MACHINE.
PATCHETT B M; COLLINS F W; TIMPSON D
CRANFIELD MEMO NO. 72. JUNE 1972. 22 PP. 16 FIG., 1 TABLE, 5 REF. CRANFIELD INSTITUTE OF TECHNOLOGY. ,
Languages: ENGLISH
THE PURPOSE OF THE DESIGN OF THIS MACHINE WAS TO LOWER THE HEAT INPUT ASSOCIATED WITH ELECTROSLAG WELDING BY PROVIDING METHODS OF ACHIEVING HIGH WELDING SPEEDS IN MILD AND LOW ALLOY STEEL PLATES TO THICKNESSES BETWEEN 25 MM AND 150 MM AND LENGTHS OF UP TO 1000 MM. WELDING SPEEDS OF UP TO 15 M/H HAVE BEEN ACHIEVED PRIMARILY THROUGH THE USE OF NARROW GAPS AND HIGH ELECTRODE WIRE FEED RATES. HEAT INPUTS HAVE BEEN REDUCED BY A FACTOR OF 3 IN COMPARISON WITH CONVENTIONAL ELECTRSLAG METHODS. AS A RESULT, SOME GRADES OF STEEL ARE SUITABLE FOR USE IN THE AS-WELDED CONDITION.

035742
IMPROVED METHODS REDUCE COSTS, INCREASE CAPACITY.
WELDING ENGINEER VOL.57, NO.8. AUG. 1972. PP. 25-29. 5 FIG.,
Languages: ENGLISH
Techniques USED IN THE NASSCO (SAN DIEGO) SHIPYARDY ARE DESCRIBED. USE OF MECHANISED HANDLING WITH GREAT EMPHASIS ON CONVEYOR BELT SYSTEMS SPEEDS UP ENTRY AND EXIT TO THE PROFILE CUTTING AND EDGE PREPARATION UNITS. USE OF SUBMERGED ARC AND CONSUMABLE GUIDE ELECTROSLAG WELDING FOR STEEL DECK PANELS AND MECHANISED OR SEMI-AUTOMATIC MIG WELDING, FOR PIPEWORK AND ALUMINIUM SUPERSTRUCTURES HAS ACHIEVED GREAT SAVINGS IN MANPOWER AND TIME.

035583
ELECTRIC WELDING.
BRITISH OXYGEN CO LTD THE
BRITISH PATENT 1 293 922. FILED: 10 MARCH 1969. COMPLETE SPECIFICATION FILED: 25 FEB. 1970. PUBLISHED: 25 OCT. 1972. 1 FIG. 6 CLAIMS. ,
Languages: ENGLISH
TO IMPROVE THE IMPACT PROPERTIES OF THE HEAT AFFECTED ZONE OF ELECTROSLAG OR ELECTROGAS WELDS THE RATE OF HEAT INPUT TO THE WELD ZONE IS VARIED WITH DISTANCE ALONG THE WELDING PATH TO PRODUCE A HEAT AFFECTED ZONE WITH NON-LINEAR BOUNDARIES. THE THERMAL CYCLING MAY BE PROOUCED BY VARYING THE WELDING VOLTAGE WHILE KEEPING THE WIRE FEED SPEED AND WELDING CURRENT CONSTANT, OR BY ADJUSTING THE WIRE FEED SPEED AND VOLTAGE SIMULTANEOUSLY IN A CHOSEN RELATIONSHIP.

033302
ELECTROSLAG WELDING IN JAPAN.
MASUMOTO I; TERAI K
TRANSACTIONS OF THE JAPAN WELDING SOCIETY VOL. 2, NO. 1. APRIL 1971. PP. 42-51. 21 FIG., 7 TABLES. ,
Languages: ENGLISH
STUDY . FOLLOWING ANSWERS RECEIVED FROM AN ENQUIRY. OF THE APPLICATIONS OF ELECTROSLAG WELDING AND ASSOCIATED PROCESSES (VERTICAL ELECTRO-GAS. WITH CONSUMABLE WIRE GUIDE, ETC.) IN JAPANESE INDUSTRY. FUTURE OF THE PROCESS.

032733
FRACTURE INITIATION IN WELD METALS,
DAWES M G
EFFECTS OF HEAT INPUT WELDING POSITION, THERMAL STRESS RELIEF TREATMENT, AND DYNAMIC STRAIN AGEING EMBRITTLEMENT. WELDING AND METAL FABRICATION. VOL. 40, NO. 3. MARCH 1972. PP. 95-104. 11 FIG., 6 TABLES, 32 REF.,
Languages: ENGLISH
COO TESTS HAVE BEEN USED TO ASSESS THE SIGNIFICANCE OF A NUMBER OF FACTORS WHICH HAVE BEEN SHOWN TO INFLUENCE THE RESULTS OF OTHER BRITTLE FRACTURE TESTS. WELD METAL WAS DEPOSITED BY THE ELECTROSLAG, CONSUMABLE GUIDE, FLUX CORED WIRE CO2, SUBMERGED ARC AND MANUAL METAL ARCL WELDING PROCESSES ON TO MILD STEEL PLATE. ALSO, THE VARIOUS WAYS IN WHICH COD TEST RESULTS MAY BE INTERPRETED ARE DEMONSTRATED, .AND THE IMPORTANCE OF MAKING TESTS IN FULL PLATE THICKNESS IS CONFIRMED.

032398
GOING UP FASTER WITH NARROW-GAP ELECTROSLAG.
BERKOVITCH I
WELDING EHGINEER VOL.56.N0. 11.NOVEMBER 1971.PP.44-45. ,
Languages: ENGLISH
THICK STEEL PLATE IS WELDED AT A RATE OF 44 IN/H BY A MODIFIED ELECTROSLAG CONSUMABLE GUIDE PROCESS. MODIFICATIONS INCLUDE A NARROWER GAP, A BASIC FLUX, HIGH CURRENTS AND A VERY HIGH RATE OF FEED FOR THE FILLER WIRE. TESTS WITH PULSED CURRENT ARE IN PROGRESS.

032129
ELECTROSLAG PROCESS SAVES MONEY BUT IT STILL HAS TO BE FULLY EXPLOITED.
APPS R L; PATCHETT B M
PROCESS ENGINEERING. JANUARY 1972. PP. 58-60. 7 FIG.,
Languages: ENGLISH
THE EFFECTS OF REDUCING THE ENERGY INPUT, BY USING HIGHER WELDING SPEEDS AND CURRENT AT LOWER VOLTAGES AND OF EMPLOYING BASIC RATHER THAN ACIDIC FLUXES ON THE QUALITY OF CONSUMABLE GUIDE WELDS HAVE BEEN STUDIED. THE TENSILE AND IMPACT PROPERTIES OF WELDED JOINTS IN THICK PLATES OF MILD STEEL, QUENCHED AND TEMPERED LOW ALLOY STEELS QT35 AND HY80 AND 2-1/4 PER CENT CR-1 PER CENT MO STEEL ARE RECORDED. IT IS CONCLUDED THAT MORE RESEARCH IS REQUIRED INTO BASIC FLUXES SPECIFICALLY FOR THE PROCESS AND INTO THE USE OF HIGHER SPEEDS BEFORE THE PROCESS WILL BE ADOPTED FOR PRODUCTION.

031967
THE ELECTROSLAG WELDING OF BENDING ROLLS,
KOZULIN M,G
AUTOMATIC WELDING VOL.24, NO.7. JULY 1971.P.70,2 FIG.,1 REF. ,
Languages: ENGLISH
A LARGE DIAMETER ROLL IN GRADE 60 STEEL, WHICH HAD FAILED BY BRITTLE FRACTURE WAS REPAIRED BY ELECTROSLAG WELDING WITH TWO CONSUMABLE GUIDES SIMULTANEOUSLY ENTERING A COMMON WELD POOL. DETAILS OF THE PRE-HEAT TEMPERATURES TOGETHER WITH WELDING PARAMETERS ARE GIVEN. NO DEFECTS WERE FOUND AFTER 100 PER CENT ULTRASONIC INSPECTION.

031596
FRACTURE INITIATION IN WELD METALS: EFFECTS OF GEOMETRY AND STRAIN RATE.
DAWES M G
WELDING INTERNATIONAL RESEARCH AND DEVELOPMENT VOL. 1, NO. 4. 1971. (13 PAGES) 8 FIG., 6 TABLES. 6 REF.,
Languages: ENGLISH
W.I. MEMBERS REPORT NO. E/33/70 JANUARY 1970.
THE EFFECTS OF SPECIMEN SIZE, LOADING RATE AND NOTCH ACUITY ON THE RESISTANCE TO FRACTURE INITIATION OF A RANGE OF COMMERCIALLY AVAILABLE MEDIUM AND HIGH TENSILE WELD METALS DEPOSITFD BY THE MMA, ELECTROSLAG, CONSUMABLE GUDE, SUBMERGED ARC AND C02 (BOTH BARE WIRE AND FLUX CORED WIRE) PROCESSES HAVE BEEN INVESTIGATED. THF RESULTS OBTAINED FROM COO TESTS WERE COMPARED WiTH THOSE FROM CHARPY IMPACT TESTS: THE LATTER WERE SHOWN TO BE LESS SENSITIVE UNDER SLOWLY APPLIED LOAD CONDITIONS.

031437
AUTOMATION OF ARC WELDING.
VERBREE M
PHILIPS WELDING REPORTER NO.71/3, 1971.PP.3-11. 11 FIGS.,,
Languages: ENGLISH
MECHANIZATION IS REGARDED AS A SIMPLE FORM OF AUTOMATION. ONLY MANUFACTURERS OF MASS-PRODUCED ARTICLES HAVE RECOURSE TO EXTENSIVE AUTOMATION: THE VAST MAJORITY OF MANUFACTURERS ALREADY BENEFIT GREATLY BY MECHANIZATION, EACH COMPANY WILL BE ABLE TO DECIDE FOR ITSELF WHERE THE LINE BETWEEN MECHANIZATION AND AUTOMATION WILL HAVE TO BE DRAWN. MORE IMPORTANT, HOWEVER, IS THE TRANSITION FROM MANUAL WORK TO MECHANIZATION. IN MANY COMPANIES MECHANIZATION IS NOT SERIOUSLY CONSIDERED AND NO INVESTMENTS FOR THIS PURPOSE ARE MADE UNTIL THE NEED IS GREATEST. SOMETIMES, OWING TO LICQUIDITY PROBLEMS, ONE CANNOT INVEST, BUT A JUSTIFIED FINANCING-AGREEMENT CAN FREQUENTLY BRING RELIEF. OFTEN FAILURE TO ASSESS THE DIFFICULTIES AND POSSIBILITIES PLAYS AN IMPORTANT PART IN THE DECISIONS CONCERNING INVESTMENT, AND SOMETIMES OLD-FASHIONEO VIEWS ON THE SUBUECT OF PROFITABILITY CALCULATIONS ARE ALSO A MAJ FACTOR . THIS ARTICLE GIVES A SURVEY OF THE DIFFERENT WELDING PROCESSES AND EQUIP-MENT USED FOR AUTOMATION. IT ENDS WITH A SHORT SURVEY ON PROFITABILITY.

031433
ELECTROSLAG WELDING THE 30KHML STEEL IN THE CONSTRUCTION OF MACHINERY FOR THE CEMENT INDUSTRY.
KOZULIN M G
AVTOMATICHESKAYA SVARKA.VOL.24 NO.6, JUNE 1971.PP.43-45, ‘3 FIGS., 3 TABLES, 3 REFS..
Languages: RUSSIAN
RUSSIAN
A TECHNOLOGY HAS BEEN DEVELOPED FOR ELECTROSLAG WELDING THE 30KHML STEEL: THIS TECHNOLOGY CAN BE USED FOR PRODUCING CAST-AND-WELDED MODELS OF MACHINES FOR THE CEMENT INDUSTRY.

031413
CONSUMABLE GUIDE ELECTROSLAG WELDING AT HIGH SPEEDS
APPS R L
PRZEGLAD SPAWALNICTWA VOL.23, NO. 10.OCT. 1971.PP.253-259. 14 FIGS., 6 TABLES, 9 REFS.,
Languages: POLISH
POLISH
THE USE OF NARROW WELD GAPS AND HIGH WELDING CURRENTS HAS ALLOWED CONSUMABLE GUIDE WELDS IN 25, 32 AND 38 MM THICK STEEL TO BM MADE AT HIGH WELDING SPEEDS (UP TO 121 MM/MIN) AND LOW HEAT INPUTS (ABOUT 20 KJ/MM). THE NARROW GAP WELDING TECHNIQUE OFFERS INCREASED PRODUCTIVITY FROM WELDING EQUIPMENT AND THE POSSIBILITY OF LOWER WELD COATS. THE LOWER HEAT INPUT RESULTS IN A SMALLER GRAIN SIZE IN THE WELD METAL AND HEAT AFFECTED ZONE. THE LIMITED RESULTS OBTAINED INDICATE THAT. COMPARED WITH CONVENTIONAL CONSUMABLE GUIDE WELDS, THE NOTCH TOUGHNESS OF NARROW GAP WELDS, AS MEASURED BY CHARPY V-NOTCH IMPACT TESTS, IS IMPROVED FOR THE WELD HEAT AFFECTED ZONE AND FUSION B0UNDARY, BUT THE WELD METAL IS UNAFFECTED.

030787
WELD PLATE THE ELECTROSLAG WAY.
IRVING R R
IRON AGE APRIL 15, 1971, 207(15), 59-61.,
Languages: ENGLISH
ELECTROSLAG, ELECTROGAS, AND CONSUMABLE NOZZLE WELDING PROCESSES ARE COMPARED.

030637
WELDING - A KEY FACTOR IN SHIPBUILDING.
BOCKHOLT R
SHIPBUILDING INTERNATIONAL. SEPTEMBER 1971. PP. 2 3, 6, 10. 8 FIGS.,
Languages: ENGLISH
EXTENSIVE LABOUR COST SAVINGS HAVE BEEN ACHIEVED IN THE SHIPYARDS OF EUROPE AND JAPAN BY ADOPTING MECHANISED WELDING PROCEDURES. THE INVESTMENT POLICIES OF A NUMBER OF YARDS, AND THE DIFFICULTIES OF MAINTAINING A SKILLED LABOUR FORCE FOR THE STILL NECESSARY MANUAL WELDING ARE DISCUSSED.

030578
PROCESS SELECTION BY ECONOMIC ANALYSIS.
NOLAN M V
METAL CONSTRUCTION AND BRITISH WELDING JOURNAL JULY 1971, VOL. 3, NO. 7, 281-284, 8 FIGS., 1 TABLE, 6 REFS..
Languages: ENGLISH
THE AUTHOR SHOWS THAT, FOR THE WELDING PROCESSES CONSIDERED, UNIT PROCESS COSTS INITIALLY DECREASE WITH INCREASING UTILISATION AND THEN TEND TO A LIMITING VALUE WHICH CAN BE CONSIDERED A PROCESS CONSTANT. THESE CURVES ARE USED TO PREDICT THE WELDING RATE ABOVE WHICH ANY PROCESS IS MOT ECONOMICAL. TO SELECT THE CHEAPEST WELDING PROCESS FOR A FIXED PRODUCTION RATE OR AS A GUIDE FOR COST ESTIMATION.

030130
A BALLING PRESS RECONDITIONED BY ELECTROSLAG WELDING.
SHEKHTER S YA; REZNITSKII A M
AVT. SVARKA VOL. 23, NO. 3, MARCH 1970, PP. 60-61, 2 FIG. 1 TABL., 1 REF.,
Languages: ENGLISH
TECHNOLOGY FOR THE REPAIR OF THE HOUSING OF A 1500 T(PRESS; ELECTROSLAG WELDING WITH CONSUMABLE WIRE GUIDE, USI THREE 4 MM DIAMETER ELECTRODE WIRES. THE HOUSING WAS MADE (170 MM THICK STEEL.

028526
PROCEEDINGS OF THE CONFERENCE MAY 14-16 1968 ON WELD DISSIMILAR METALS.
PROC
METAL CONSR BRIT WELD J V 1 N 12S DEC 1969 159 P.,
Languages: ENGLISH
NINETEEN PAPERS COVERING NEWER WELDING PROCESSES F DISSIMILAR METAL JOINTS,CLAOOINB BY WELD DEPOSITION,.TRANSITI JOINTS FOR HIGH TEMPERATURE SERVICE,AND FABRICATION AN SERVICE EXPERIENCE.DISCUSSIONS ARE INCLUDED.

028433
FIVE TIMES AS FAST WITH ULTRA HIGH SPEED WELDING.
BERKOVITCH I
THE ENGINEER 29 JULY 1971,VOL.233,N0.6021 ,36-37 ,3 DIGS., TABLE. , , .
Languages: ENGLISH
THE PRINCIPLES AND ADVANTAGES OF CONSUMBALE GUIDE WELDI ARE DESCRIBED. INDUSTRIAL DEVELOPMENT OF THE NEW PROCESS WI DEPEND UPON ECONOMIC FACTORS AND ACCEPTANCE BY THE INSURAN COMPANIES.

027711
WELDING BY FUSION.
SMIT NIJMEGEN ELECTROTECHE FABRIEKEN N V
BRITISH PATENT: 1 218 132. FILED: 29 JUNE 1967. PUBLISHED 20 JUNE 1968.,
Languages: ENGLISH

027702
WELDING BY FUSION.
WHESSOE LTD.
BRITISH PATENT: 1 219 190. FILED: 31 MAY 1968. PUBL1SHED: 30 APRIL 1969.,
Languages: ENGLISH

027350
TETRAS 'TURN-ON TOSHIBA-II-II PAVILLION AT EXPO 70.
WDG ENG. VOL.55, NO.7, JULY 1970, PP. 24~26, 7 FIGS.,
Languages: ENGLISH
DESCRIPTION OF THE FABRICATION BY ELECTROSLAG WELDING WITH CONSUMABLE WIRE GUIDE OF 1476 TETRAS MADE OF 16 TO 36 MM THICK STEEL WHICH ARE THE KEY ELEMENTS OF THIS CONSTRUCTION.

027349
NEW IDEAS IN SKYSCRAPERS,
GLIODEN B
WDG.DES.FAB(. VOL.43, NO.10, OCT. 1970, PP. 75-78, 11 POT.,
Languages: ENGLISH
CONSTRUCTION IN PITTSBURGH, USA, OF A 64 STORY BUILDING, THE UNITED STATES STEEL BUILDING. THE SIX GRADES OF HIGH STRENGTH STRUCTURAL STEELS(ASTM A36, A572 GRADES 42, 50 AND 60, ASTM A514 TYPE F (T-I), AND ASTM A588 GDRADE (COR-TEN) ARE SWLDED BY THE C02 SUBMERGED ARC, ELECTROSLAG WITH CONSUMABLE WIRE GUIDE PROCESSES, BY ARC WELDING WITH STICK ELECTRODES AND BY THE MIG PROCESS WITH SOLID OR FLUX-CORED WIRE. MAGNETIC PARTICLE AND ULTRASONIC INSPECTION.

027243
MINIATURIZATION OF ELECTROSLAG WELDING:A NEW METHOD FOR WELDING RELATIVELY THIN PLATES.
BOEKHCILT R
LASTECHN. VOL,36, NO.12, DECEMBER 1970, PP. 261-268, 13 FIG., 1 TABLE, 7 REF.,
Languages: DUTCH
DUTCH
PRINCIPLE OF ELECTROSLAG 'MICROWELDING'. METALLURGICAL REACTIONS. ADVANTAGES. PARTICULARLY ITS LOW HEAT INPUT AND ITS MECHANICAL PROPERTIES ACCEPTABLE IN THE AS WELDED CONDITION. EQUIPMENT USED, IN PARTICULAR WITH COATED WIRE GUIDE.

027238
ELECTROSLAG, ELECTROGAS AND RELATED WELDING PROCESSES.
CAMPBELL H C
WDG.RES.COUNCIL BULL.NO. 154, SEPT. 1970, PP. 1-22, 31 FIG.,
1 TABLE, 65 REF.,
Languages: ENGLISH
DIFFERENCE BETWEEN THE TWO: ELECTROSLAG WELDING IS A PROCESS WHEREAS ELECTROGAS WELDING IS ONLY A METHOD OF GAS SHIELDED ARC WELDING OR FULLY-COREO ARC WELDING. PRINCIPLES OPERATION; HISTORY. NUMBER OF WELDING MACHINES IN SERVICE THE WORLD. FIELDS OF APPLICATION. MODIFICATIONS CARRIED OUT THE WELDING HEADS FOR THE USE OF THESE TWO PROCESSES SHIPBUILDING. THEIR VARIANTS: ELECTROSLAG WELDING W CONSUMABLE WIRE GUIDE, ELECTROGAS WELDING WITH SOLID FLUX-CORED WIRE. WELDING EQUIPMENT. INSPECTION OF WELDS.

027237
WHERE TO CONSIDER ELECTROSLAG WELDING.
HANNAHS J; LEA D
MET.PROGR. VOL.98, NO.5, NOV. 1970,PP.62-64, 4 PHOT.,
Languages: ENGLISH
DIFFERENCES BETWEEN CONVENTIONAL ELECTROSLAG WELDING ELECTROSLAG WELDING WITH CONSUMABLE WIRE GUIDE. THE PROCESS ONLY PROFIT-EARNING WHEN PLATES ARE OVER 3/4 IN.THI EXAMPLES OF APPLICATION: FOR THE PRODUCTION OF MILL MACHINES, PRESS FRAMES, BRIDGES ETC.

027014
ELECTROSLAG WELDING OF CAST IRON
ISHII Y
TRANS.JAP.WELD.SOC. SEPT. 1970. I.(2), 241-252, 15 FIGS, TABLES, 2 REFS.,
Languages: ENGLISH
A NEW ELECTROSLAG WELDING OF CAST IRON PLATES USIN CONSUMABLE ELECTROSLAG WELDER IS DISCUSSED. USES OF A M STEEL WIRE, A SILICON-CONTAINING WIRE, A CORED WIRE CONTAIN WHITE CAST IRON OR GREY CAST IRON POWDER AND A CAST IRON ARE COMPARED. MAJOR RESULTS OBTAINED ARE AS FOLLOWS; WELDING WITH A MILD STEEL WIRE IS EASY TO EXECUTE BUT RESU IN AN EXTREMELY HARD WELD METAL WHICH IS DIFFICULT TO MACHI 2) USE OF A HIGH SILICON WIRE PRODUCES A CONSIDERABLY L HARD WELD METAL THAN THAT OF A MILD STEEL WIRE, BUT RESULTS ARE NOT FULLY SATISFACTORY. 3) USE OF A CORED W WITH A GRAPHITE NOZZLE GIVES THE BEST RESULTS WITH HARDNESS, TENSILE STRENGTH, COLOUR TONE AND DAMPING FACTOR WELD METAL ABOUT THE SAME AS THOSE OF BASE METAL. 4) USE O CAST IRON ROD IS USEFUL IN WELDING A SHORT LENGTH JOB. AB0UT FLUXES EXPERIMENTALLY PREPARED WITH THE AIM TO OBTAI LOWER TEMPERATURE FUSIBLE FLUX, THE BEHAVIOUR DURING WELDI PROPERTIES OF WELD METAL AND PHYSICAL PROPERTIES OF MOL SLAG HAVE BEEN CHECKED.

026182
WELDING IN JAPAN
TICHELAAR G W
LASTECHN. VOL 36, NO 5, MAY 1970, PP. 94-97. 8 REF.,
Languages: DUTCH
DUTCH
STATE IN 1969, OF THE FOLLOWING PROCESSES: AUTOMATIC ARC WELDING WITH STICK ELECTRODES (BY GRAVITY, BY THE FIRECRACKER PROCESS, ETC), SUBMERGED ARC, ONE SIDE MANUAL ARC WELDING, GAS SHIELDED, ELECTOSLAG, EXPLOSIVE , ELECTRON BEAM AND PLASMA WELDING, STUD WELDING. BRIEF SURVEY OF THE EDUCATION OF WELDING ENGINEERS.

026044
REPAIR BY ENCLOSED WELDING,OF THE RAM OF A DROP HAMMER.
JARAUSCH R HUTTENES K; BECKEN O
PRAKT/SCHW.SCHN.VOL 22 NOS 7 AND 8,JULY AND AUG 1970,PP. 150-53 AND 181-83,20 FIG.,
Languages: GERMAN
GERMAN
REPAIR OF A 38 TON RAM IN C 45 STEEL(0.36 C-0.22SI-0.62 MN-0.015 P-0.024 S)BROKEN IN TWO PARTS IN AN APPROXIMATELY HORIZONTAL PLANE.AFTER MANY WELDING TESTS,20 ENCLOSED WELDS 2.4 M LONG WERE MADE USING CONSUMABLE GUIDES,2.2 M IN LENGTH IN ST37-3 STEEL.WELDING PARAMETERS.A STRESS-FREE ANNEALING WAS THEN APPLIED AT 600DEG.C, FOLLOWING BY CONTROLLED COOLING:ULTRASONIC,MAGNETIC PARTICLE AND DYE-PENETRANT TESTING.RECOMMENOATIONS FOR THE REPAIR OF OTHER LARGE PARTS.

026009
NEW IDEAS IN BUILDING CONSTRUCTION.
WOG.DES.FABR. VOL 43,N0 6,LJUNE 1970,PP.68-70,3 FIG.,
Languages: ENGLISH
CONSTRUCTION OF A 64 STORY OFFICE BUILDING IN PITTSBURY,USA:THE GIRDERS AND COLUMNS ARE VISIBLE.THE COLUMNS ARE FILLED WITH WATER TO FIREPORRF >HEM.USE OF COR-TEN.ASTM A-36,EX-TEN 42,50 AND 60,T-I STEELS.MANUAL ARC WELDING,MIG WELDING WITH SOLID AND FLUX CORED WIRE,SUBMERGEO ARC AND ELECTROSLAG WELDING WITH CONSUMABLE WIRE GUIDE.

025990
ELECTROSLAG WELDINF OF CAST IRON (REPORT 1).
ISHII Y; TAMURA H; KATO N; TEZUKA Y; MURASE K
J. JAP. WDG. SOC. VOL. 39, NO. 3, MARCH 1970, PP. 79-90, 21 FIG. , 7 TABL., 2 REF.,
Languages: JAPANESE
JAPANESE
DEVELOPMENT OF A METHOD FOR JOINING CAST IRON BY ELECTROSLAG WELDING WITH CONSUMABI.E WIRE GUIDE. TESTS WERE CARRIED OUT WITH FOUR FILLER METALS: A MILD STEEL WIRE, A SILICON WIRE, A FLUX CORED WIRE CONTAINING WHITE OR GREY CAST IRON POWDER AND A MEEHANITE CAST IRON ROD. RECOMMENDATION FOR THIS OPERATION OF THE FLUX CORED WIRE OR OF THE CAST IRON ROD CONTAINING 3.05 TO 3.38 PERCENT C AND 1.73 TO 2.58 PERCENT S1 WHICH GIVE EXCELLENT RESULTS REGAROING HARDNESS STRENGTH AND COLOUR OF THE JOINT.

025918
METHOD FOR SAVING WORKING HOURS IN ELECTROSLAG WELDING WITH CONSUMABLE WIRE-GUIDE.
ARIKAWA M: KANO M; WATANABE T; TANIGUCHI M
WDG. TECH. VOL. 17, NO. 10, OCT. 1969, PP. 34-40, 13 FIG., 2 TABL.,
Languages: ENGLISH
DEVELOPMENT OF A DEVICE WHICH AUTOMATICALLY SUPPLIES THE FLUX AND THE OPERATING OF WHICH IS BASED ON THE FLUCTUATION OF THE WELDING VOLTAGE WHEN THE THICKNESS OF THE MOLTEN SLAG IS TOO SMALL. THIS METHOD (OS-KOB) WHICH IS APPLICABLE TO ALL ELECTROSLAG WELDING METHODS, IS PARTICULARLY EFFICIENT IN ELECTROSLAG WELDING WITH CONSUMABLE WIRE GUIDE. APPLICATION OF THIS METHOD IN JAPANESE SHIPYARDS.

025186
ONE-SIDE WELDING IS STRONG IN JAPAN.
B1SKUP J T
CAN.MACH.METALWORK. MAY 1970, 81, (5)- 76-79, 109..
Langauages: ENGLISH
SOME OF THE IMPROVED PROCESS APPLICATIONS RESPONSIBLE FOR THE HIGH RATE OF WELDED PRODUCTIVITY IN STEEL, FABRICATION IN JAPAN ARE : ONE-SIDE WELDING BY THE GAS-METAL-ARC, FLUX-CORED-ARC , MANUAL-SHIELDED-ARC AND SHIELDED-ARC WELDING PROCESSES: GRAVITY-ARC WELDING FOR HORIZONTAL FILLETS, A PROCESS IN WHICH THE ELECTRODE HOLDER SLIDES DOWN AUTOMATICALLY UNDER ITS OWN WEIGHT: TO FEED THE ELECTRODE FOR WELDING; INCLINATION OR CONTACT WELDING, A PROCESS FOR WELDING IN SMALL. CONFINED SPACES IN WHICH THE ELECTRODES IS UNDER SPRING PRESSURE AND IS SET AT A VERY LOW ANGLE; AND ELECTROSLAG WELDING WITH A CONSUMABLE NOZZLE, PARTICULARLY A NOZZLE COATED WITH ADDITIONAL RINGS OF SOLID AND INTERMITTENT FLUX .

024619
FILLING BLIND HOLES BY ELECTROSLAG WELDING WITH A MOVING CONSUMABLE NOZZLE.
POSTOVALOV YU I; VOLOSHKEVICH G Z
SVAR. PROIZV. VOL 16. NO 6, JUNE 1969, PP. 17-18, 5 FIG., 2 TABL; ,
Languages: ENGLISH
EFFECTS OF THE VARIOUS PARAMETERS OF THE PROCESS ON THE DEPTH OF PENETRATION AND THE QUALITY OF THE JOINTS.

024360
REPORT ON VISITS TO JAPANESE SHIPYARDS.
TURNER M J
METAL CONSTRUCTION AND BRITISH WELDING JOURNAL JUNE 1970, 2, 6, 219-226. 9 FIGS,, 4 TABLES, 3 REFS.,
Languages: ENGLISH
IN THIS REPORT ON VISITS TO TWELVE JAPANESE SHIPYARDS THE AUTHOR DESCRIBES THEIR ORGANISATION AND SUPERVISION STRUCTURE; PAY SCALES AND FRINGE BENEFITS FOR WELDERS; STOCKYARD MARKING AND CUTTING OPERATIONS; WELDER TRAINING; RESEARCH IN PROGRESS; WELDING PRACTICES, INCLUDING ONE SIDE WELDING, AUTOMATIC WELDING OF BUTTS AND SEAMS ON THE BERTH, AND CONSUMABLE GUIDE WELDING OF STIFFENERS. WHERE APPROPRIATE, THE AUTHOR MAKES COMPARISONS WITH UK PRACTICE.

024253
ELECTROSLAG WELDING EQUIPMENT.
DE CONINCK VAN NOYEN P
REV. SOUD. VDL. 26, NO. 1, QST QUARTER 1970, PP. 30-39, 21 FIG., 1 TABL.,
Languages: FRENCH
FRENCH
GENERAL ON ELECTROSLAG WELDING EQUIPMENT: SPECIALISEO SEMI-AUTOMATIC AND AUTOMATIC MACHINES (WITH CONSUMABLE WIRE-GUIDE, FOR HEAVY THICKNESSES, FOR WELDING WITH ADDITION OF METAL POWDER): JIGS: POWER SOUCES.

023836
DESIGNING FOR THE NEWER WELDING PROCESSES.
HICKS J G
ENGINEERING DESIGN '70 PP. 4-10. 14 FIGS., 3 TABLES. ,
Languages: ENGLISH
A REVIEW OF FIVE OF THE NEWER WELDING PROCESSES - PULSED ARC , ELECTRON BEAM, PLASMA ARC, CONSUMABLE GUIDE, FRICTION WELDING. AFTER AN INTRODUCTORY EXPLANATION OF THE MODE OF OPERATION OF EACH PROCESS, THEIR SCOPE AND LIMITATIONS ARE CONSIDERED FROM THE DESIGNER'S POINT OF VIEW.

022895
ELECTROSLAG MELTED TRANSITION-PIECE UNITS AS AN ALTERNATIVE TO DIRECT WELDING.
BENNETT A P; EATON N F
METAL CONSTRUCTION AND BRITISH WELDING JOURNAL VOL. 1, NO. 12S, DECEMBER 1969, 59-65. 10 FIGS.. 16 REFS.,
Languages: ENGLISH

022658
VERTICAL POSITION WELDING.
SNIEGON K
PRZEGL. SPAW. VOL 20, NO 9, SEPT 1968. PP. 213-22, 16 FIG, 9 TABL, 4 REF.,
Languages: POLISH
POLISH
TECHNOLOGY OF AUTOMATIC VERTICAL POSITION C02 AND ELECTROSLAG WELDING WITH CONSUABLE WIRE GUIDE. WELDING VARIABLES FOR THICKNESSES FROM 12 TO 400 MM. COMPARISON OF THE WELDING TIMES FOR VARIOUS METHODS. THE SELECTION OF THE FILLER METAL DEPENDS ON THE QUALITY OF THE PARENT METAL, ON ITS THICKNESS AND ITS LENGTH AS WELL AS ON THE WELDING METHOD CHOSEN AND ON THE TYPE OF WELDING MACHINE. MECHANICAL PROPERTIES OF THE VERTICALLY WELDED *JOINTS* MADE BY THE GAS SHIELDED AND ELECTROSLAG PROCESSES.

021977
INVESTIGATIONS IN CONSUMABLE GUIDE WELDING.
NOLAN M V; APPS R L
WELDING AND METAL FABRICATION NOVEMBER 1969, 37, 1I, 464-470, 10 FIGS, 6 TABLES, 14 REFS.,
Languages: ENGLISH
THE SUSCEPTIBILITY TO BRITTLE FRACTURE OF CONSUMABLE GUIDE WELDS (BOTH CONVENTIONAL AND NARROW GAP) MADE IN 1 1/2 IN. SILICON-KILLED MILD STEEL PLATE WAS INVESTIGATE AND COMPARED WITH THAT OF THE PARENT METAL AND OF SUBMERGED ARC WELDS BY MEANS OF THE PELLINI DROP WEIGHT TEST. THE EFFECT OF VARIATION OF WELDING PARAMETERS UPON THE DIMENSIONS AND PROPERTIES OF WELDS WAS EXAMINED. THE WELD METAL WAS SHOWN TO GIVE NIL-DUCTILITY TEMPERATURES SUBSTANTIALLY SUPERIOR TO THAT OF THE PARENT PLATE, BUT INFERIOR TO THAT OF SUMERGED ARC WELD METAL. IT WAS FOUND THAT USING NARROW GAP JOINTS CONSIDERABLE INCREASES IN WELDING SPEED (OVER 20 FT/HR) COULD BE ACHIEVED, THUS REDUCING HEAT INPUT AND, THEREFORE, BOTH WELD AND HEAT AFFECTED ZONE GRAIN SIZE.

021944
ELECTROSLAG WELDING WITH COATED CONSUMABLE NOZZLES.
MATSUOKA T: ARAKI M: SUZUKI H: MURAI K
BR.WOG J VOL 14, NO 6, JUNE 1967, PP.287-98. 16 FIG, 8 TABL, 3 REF.,
Languages: ENGLISH
DEVELOPMENT AND APPLICATIONS OF A NEW AND SIMPLIFIED ELECTROSLAG WELDING (SES) PROCESS. MAIN CHARACTERISTICS OF THIS PROCESS, EQUIPMENT USED, WELDING PROCEDURE AND TYPICAL OPERATING CONDITIONS. POSSIBILITY OF WELDING MILD OR HIGH STRENGTH STEEL PLATES 12 TO 60 MM THICK WITH A SINGLE COATED CONSUMABLE WIRE GUIDE, 150 MM THICK WITH 2 WIRE GUIDES AND 250 MM THICK WITH 4 WIRE GUIDES. MECHANICAL PROPERTIES OF THE WELDS.

021614
ELECTROSLAG FOR KWINARA POWER STATION STRUCTURAL.
WOG NEWS NO 133, APRIL 1968, PP.5-6, 4 FIG, 2 TABL.,
Languages: ENGLISH
QUALIFICATION OF THE PROCESS (ELECTRDSLAG WELDING WITH CONSUMABLE WIRE GUIDE): PRODUCTION IN SHOP OF BUTT WELDS FOR (JOINING COLUMN ELEMENTS MADE OF 2 IN. THICK PLATES AND COLUMNS TO BASEPLATES OF VARIOUS THICKNESSES.

020854
THE CONSUMABLE NOZZLE ELECTROSLAG WELDING PROCESS WITH MOVABLE CURRENT TERMINAL.
NAKAJIMA M; ISHIKAWA Y; SHIMAMOTO T
MITSUBISHI TECH. REV. JAN. 1969, 6, (l), 1-9.,
Languages: ENGLISH
THIS IS AN AUTOMATIC, SINGLE-PATH VERTICAL WELDING METHOD SIMILAR TO THE ORDINARY TYPE OF CONSUMABLE NOZZLE WELDING. THE APPARATUS AND ITS OPERATION IS DESCRIBED IN DETAIL. THE QUALITY OF l-HE WELDS PRODUCED BY THE NEW METHOD HAS BEEN INVESTIGATED AS A FUNCTION OF WELDING VARIABLES; THE PROPERTIES OF THE WELD ARE DISCUSSED. THE PROCESS IS MUCH CHEAPER TI-IAN CURRENT WELDING METHODS.

020852
WELDING THE HEAVY ONES.
LEA O
AMER. MACH. 7 APR. 1969, 113, (7), 92-94.,
Languages: ENGLISH
LARGE WELD JOINTS IN RAILS NEEDED FOR GANTRY-TYPE. NUMERICALLY CONTROLLED MACHINING CENTERS ARE PRODUCED BY ELECTROSLAG WELDING WITH A CONSUMABLE GUIDE SYSTEM. THE SYSTEM USED DIFFERS FROM OTHER CONSUMABLE GUIDE SYSTEMS IN THAT TWO OF THE THREE AVAILABLE WELDING HEADS HAVE OSCILLATION MECHANISMS TIIAT MOVE THE ELECTRODE FROM SIDE TO SIDE IN THE JOINT, ALLOWING THE SYSTEM TO WELD THICKER MATERIALS WITH MORE UNIFORM PENETRATION AND FEWER ELECTRODES. WELDS IN PLATES, 11 X 56 X 204 IN. HAVE BEEN PRODUCED WITH ONLY 4-HR CRANE TIME AND A SAVINGS OF 65 MANHOURS IN WELDING TIME.

020840
WHAT'S UP IN VERTICAL WELDING.
SOREF E
WELD. DESIGN FABR. MAR. 1969, 42, (3), 77-79.,
Languages: ENGLISH
FOUR MAKES OF WELDERS AND THEIR capabilities AND OPERATING FEATURES ARE DESCRIBED. THEY ARE: THE AUTOMATIC VERTICAL AIRCOMATIC, BUILT BY AIRCO: THE VERTOMATIC, BY ARCOS; THE PORTA-SLAG, BY HOBART: AND CONSUMABLE GUIDE ELECTROSLAG WELDERS, BY LINDE. ALL THE SYSTEMS ARE VARIATIONS OF ELECTROSLAG OR ELECTROGAS WELDING. PLATE THICKNESSES FROM 3/8 TO 24 IN. CAN BE WELDED, DEPENDING ON THE MACHINE CHOSEN. ONE MACHINE CAN WELD HY90, HY80, AUSTENITIC STAINLESS AND HIGH-C STEELS, MONEL AND INCONEL.

020700
WELDING IN MODERN SHIP CONSTRUCTION.
CUTHBERT O
WELDING AND METAL FABRICATION APRIL 1969, 37, 4, 122-132, 14 FIGS., 4 TABLES. ,
Languages: ENGLISH
A SURVEY OF WELDING PROCESSES AND TECHNIQUES IN USE AND AVAILABLE FOR USE IN SHIPYARDS IN THE UK, EUROPE AND LIAPAN. USE OF MANUAL AND AUTOMATIC PROCESSES IS COMPARED FOR THESE THREE AREAS, TOGETHER WITH PRODUCTION TECHNIQUES AND SCHEDULING. THE AUTHOR CONCLUDES THAT GOOD ORGANISATION, ACCURATE FIT-UP AND FLEXIBILITY OF WORK FORCE AND WELOING METHOD ARE TH E DECIDING FACTORS IN SHIP BUILDING.

020658
ELECTROSLAG WELDING WITH CONSUMABLE GUIDE ON THE BANK OF AMERICA WORLD HEADQUARTERS BUILDING.
AGIC T; HAMPTON J A
WELD.J. EC. 1968. 47, (12), 939-946. ,
Languages: ENGLISH
INTERNAL FULL PENETRATION PLATE WELDS IN A-441 AND A-36 STEEL BOX COLUMNS UP TO 47 FT LONG ARE MADE BY ELECTROSLAG WELDING WITH A CONSUMABLE GUIDE TUBE. A FLUX COATING ON THE OUTSIDE OF THE TUBE PROVIDES ELECTRICAL INSULATION AND AUTOMATIC FLUX ADDITION DURING WELDING. COPPER MOLDS, WITH OR WITHOUT WATER COOLING, ARE ATTACHED TO THE WELD JOINT TO SERVE AS DAMS FOR THE MOLTEN METAL. A 2 PER CENT MN WIRE IS USED TO OBTAIN THE REQUIRED 50,000 PSI YIELd STRENGTH, 70,000-90,000 PSI ULTIMATE STRENGTH, 22 PER CENT ELONGATION ANd 40 PER CENT REUDUCTION OF AREA. TYPICAL WELD CONDITIONS ARE TABULATED FOR VARIOUS PLATE THICKNESSES. ILLUSTRATIONS SHOW THE L WELD SEQUENCE USED TO JOIN CONTINUITY PLATES TO FLANGE MEMBERS AND THE U WELD SEQUENCE USED TO JOIN THE PLATES TO WEB MEMBERS. A COVER PLATE FLANGE IS ALSO WELDED BY THIS METHOO. LONGITUDINAL PARTIAL PENETRATION WELDS ON THE COLUMNS ARE PERFORMED BY A CONVENTIONAL SUBMERGED-ARC PROCESS WITH THE DUAL ELECTRODE DIRECT CURRENT-ALTERNATING CURRENT SYSTEM.

020634
WELDING IN EUROPEAN SHIPYARDS.
NORCROSS J E
METAL PROGR. JAN. 1969, 95, (1), 88-92.,
Languages: ENGLISH
RECENT DEVELOPMENTS USED IN EUROPEAN SHIPYARDS INCLUDE: A ONE-SIDE WELDING PROCESS USING BLENDED POWDERS AND AUTOMATIC WELDING WITH EITHER THE GAS METAL ARC PROCESS OR SUBMERGED ARC PROCESS TO L-JOIN DECK PLATES; A VARIATION OF THE ELECTROSLAG PROCESS, (CONSUMABLE-N022LE WELDING WHICH IS USED TO MAKE VERTICAL JOINTS AS IN THE WELDING OF DECK STIFFENERS IN PLACE): AN ELECTROGAS WELDING HEAD MOUNTED IN AN ENCLOSED TOWER AND EASILY MOVED BY CRANE FROM JOINT TO JOINT IN THE WELDING OF VERTICAL JOINTS IN HULL PLATES; GRAVITY FED ELECTRODES WHICH INCREASE OUTPUT ANd REDUCE OPERATOR FATIGUE; VERTICAL-DOWN ELECTRODES FOR SINGLE-PASS VERTICAL FILLET WELDS: SEMIAUTOMATIC GAS METAL ARC WELDING USING SOLID ELECTRODES AND C02 SHIELDING TO ELIMINATE FLUX REMOVAL OPERATIONS DURING MULTIPASS WELDS: SUBMERGED ARC WELDING WITH MULTIPLE ELECTRODES FOR MAKING BUTT WELDS IN PLATES: AND FILLET WELDING OF STIFFENERS TO SIDE AND DECK PLATES.

014938
HEAT CONDITIONS OF ELECTROSLAG SURFACING OF STEEL G13 ON TO LOW-CARBON STEEL.
SHVARTSER A YA; ZOLOTAREVSKY D B
AVTOMAT. SVARKA APR. 1968, (4). 16-19.,
Languages: ENGLISH
ELECTROSLAG SURFACING EXPERIMENTS OF STEEL G13 ON ST. 3 WERE CARRIED OUT USING A CERAMIC CONSUMABLE TIP. DISTRIBUTIONS OF TEMP. IN THE TRANSVERSE AND LONGITUDINAL SECTION OF THE SPECIMEN WERE DETERMINED. EFFECTS OF COOLING RATE ON THE SURFACED METAL STRUCTURE AND RELATIONSHIP BETWEEN THE STRENGTH OF THE WELD SEAM AT VARIOUS MO-CONTENTS IN THE SURFACED METAL AND AT VARIOUS RATES OF COOLING WERE INVESTIGATE.

014878
MANAGMENT TAKES A LOOK AT THE NEW GENERATION OF WELDING PROCESSES.
IRVING R R
IRON AGE. VOL. 201, NO. 12. 21 MARCH 1968. PP. 81-88.,
Languages: ENGLISH
A REVIEW OF NEW WELDING PROCESSES INCLUDES: ELECTRON BEAM WELDING: VERTICAL WELDING BY ELECTROSLAG, ELECTROGAS, AVA AND CONSUMABLE-NOZZLE ELECTROSLAG PROCESSES: MIG WELDING; FILLET WELDING USING CONVENTIONAL SOLID WIRE SHIELDED BY A; OPEN-ARC OR GASLESS FLUX-COREO WIRE PROCESSES; PULSED ARC POWER SOURCE WELDING; CYCLE SURGE SYSTEM, WHICH CAN BE PULSED AT 60 OR 120 CYCLES , OR OPERATE AT CONSTANT POTENTIAL; PINCH ARC SYSTEM, WHICH CAN BE USED WITH SOLID OR FLUXCORED WIRES AND WITH SUBMERGED ARC WELDING; LINDE'S HOT WIRE WELDING PROCESS, IN WHICH A SEPARATE POWER SOURCE IS EMPLOYED TO PREHEAT THE FILLER METAL; MAPP GAS MECHANISED WELDING; THE WATER WELDER IN WHICH DISTILLED WATER IS USED: AND THE PLASMA NEEDLE ARC METHOD .

013778
ELECTROSLAG WELDING WITH CONSUMABLE NOZZLE.
ERIKSON S
NORGAS TIOS VOL 32, NO 2, 1968, PP.29-31, 9 FIG.,
Languages: NORWEGIAN
NORWEGIAN
DESCRIPTION OF THIS PROCESS, SUITABLE FOR WELDING PLATES 12 TO 100 MM. THICK.

013776
PRESENT STATE AND FUTURE PROSPECTS OF ELECTROSLAG WELDING.
MAKARA A M; BEL,FOR M G
SVAR.PROIZV VOL 13, NO 11. NOV 1967. PP.27-30, 6 FIG, 14 REF.,
Languages: ENGLISH
USE OF THIS PROCESS FOR JOINING COMPONENTS WITH A THICKNESS RANGING BETWEEN 12 AND 2000 MM AND FOR SURFACING. USE OF WELDING WIRES 5-6 MM IN DIAMETER. NEW TECHNIQUES OF THE PROCESS: ELECTROSLAG WELDING WITH A COATED CONSUMABLE WIRE GUIDE: WELDING AND SURFACING WITH STRIP ELECTRODES. FUTURE OF THE SEMI-AUTOMATIC ELECTROSLAG PROCESS FOR WELDING OPERATIONS ON SITE. EQUIPMENT USED FOR THESE VARIOUS DTECHNIQUES. RESEARCHES IN PROGRESS FOR IMPROVING THE WELDING TECHNIQUES AND RATES, FOR AVOIDING WELDING DISTORTIONS AND FOR ELIMINATING THE REQUIREMENT OF A HIGH TEMPERATURE HEAT TREATMENT AFTER WELDING.

013211
ELECTROSLAG WELDING WITH CONSUMABLE WIRE GUIDE. ECONOMY AND FIELD OF APPLICATION
GUTTORMSEN K
SVEISETEKNIKK VOL 22, NO 5/6 DEC 1967, PP. 89-92, 94-97 AND 108, 20 FIG, 5 REF,
Languages: NORWEGIAN
NORWEGIAN

013207
APPLICATION OF ELECTROSLAG WELDING WITH CONSUMABLE WIRE GUIDE TO STEEL CONSTRUCTIONS
OUMEZU S: TAKAOA S: SAKOURAI R
SWEISS. SCTlNEO. VOL 20, NO 3, MARCH 1968, P. 135, 1 FIG,
Languages: GERMAN
GERMAN FROM D0C. IIS/IIW-XII-I-2-67
VAKIOUS APPLICATIONS OF ELECTROSLAG WELDING WITH BARE OR COATED CONSUMABLE WIRE GUIDE. RESULTS OBTAINED WITH EACH METHOD. THE MAIN ADVANTAGE OF THIS PROCESS IS ITS ECONOMY.

012202
VERTICAL ELECTROSLAG WELDING.
MARCHAL M
PRAT. IND. MEC. VOL 55, NO 12, DEC 1967, PP. 335-38, 10 FIG, 4 REF.,
Language: FRENCH
FRENCH
PRINCIPLE OF THE ELECTROSLAG WELDING PROCESS; PROCEDURE: EQUIPMENT: FIELDS OF APPLICATION; WELDING WITH CONSUMABLE WIRE GUIDE .

012197
AUTOMATIC WELDING OF BUTT JOINTS IN T-SECTION COMPONENTS.
TREPOV P V
AVT. SVARKA VOL 20. NO 6. JUNE 1967, PP. 53-54. 5 FIG, 2 REF. .
Languages: ENGLISH
WELDING OF THESE SECTIONS WITH A DEVICE ALLOWING THE CONTAINED FORMATION OF THE WELD POOL, CONSISTING OF A THREE ELECTRODE AUTOMATIC WELDING HEAD, TWO SIDE ONES AND A CENTRAL ONE WITH CONSUMABLE WIRE GUIDE. WELDING STARTS WITH THE THREE ELECTRODES SIMULTANEOUSLY. DESCRIPTION OF THE PROCEDURE.

011633.
CONSUMABLE GUIDE WITH CERAMIC FLUX FOR ELECTROSLAG HARDFACING.
ZOLOTAREVSKII D B CHERNYSHENKO I G GANZHA V F: OYBRIN N G
SVAR.PROIZV VOL 13,N0 4'APRIL 1967,PP.36-37,4 FIG,I TABL.,
Languages: ENGLISH
DESCRIPTION OF THIS HARDFACING PROCESS AND OF THE PROCEDURE.OESIGN OF GUIDES USED ACCORDING TO THE WIDTH OF THE HARDFACING TO BE CARRIED OUT.

011607
CONSUMABLE NOZZLE ELECTTOSLAG WELDING OF MILD STEEL.
COPLESTON F W
DANSK TEKN.TIOSS.D VOL 90,N0 5,MAY t967,PP. 167-74,9 FIG,3 TABL,6 REF.,
Languages: DANISH
DANISH

011223
THE ELECTROSLAG WELDING OF TITANIUM WITH A CONSUMABLE GUIDE.
GUREVICH S M; KOMPAN YA YU
AVT. SVARKA VOL 20, NO 1, JAN 1967, PP 65-8, 4 FIG, 2 TABL, 5 REF..
Languages: ENGLISH
POSSIBILITY OF WELDING LARGE COMPONENTS IN TITANIUM ALLOYS BY THE ELECTROSLAG PROCESS. USE OF ARGON FOR SHIELDING THE LIOUID METAL FROM THE SURROUNDING AIR.

011114
ELECTROSLAG WELDING WITH COATEO CONSUMABLE NOZZLES.
MATSUOKA T; ARAKI M; SUZUKI H; MURAI K
BR. WDG J. VOL 14. NO 6, JUNE 1967, PP 287-98. 16 FIG, 8 TABL, 3 REF.,
Languages: ENGLISH
DEVELOPMENT AND APPLICATIONS OF A NEW AND SIMPLIFIED ELECTROSLAG WELDING (SES) PROCESS. MAIN CHARACTERISTICS OF THIS PROCESS, EQUIPMENT USED. WELDING PROCEDURE AND TYPICAL OPERATING CONDITIONS. POSSIBILITY OF WELDING MILD OR HIGH STRENGTH STEEL PLATES 12 TO 60 MM THICK WITH A SINGLE COATED CONSUMABLE WIRE GUIDE, 150 MM THICK WITH 2 WIRE GUIDES AND 250 MM THICK WITH 4 WIRE GUIDES. MECHANICAL PROPERTIES OF THE WELDS .

010527
CONSUMABLE NOZZLE ELECTROSLAG WELDING OF MILD STEEL.
COPLESTON F W
SEC. COMMONWEALTH WDG CONF. LONDON 1965, PP. 55-62, 9 FIG, 3 TABL, 6 REF. DISC. P. 79.,
Languages: ENGLISH
WELDING TECHNIQUE USING A SINGLE OR SEVERAL WIRES. THICKNESSES OF PLATE AND LENGTH OF WELD WHICH MAY BE WELDED. SPECIAL TECHNIQUES FOR WELDING IRREGULAR SHAPES ENCOUNTERED IN SHIPBUILDING AND IN THE INDUSTRY. COMPARISON OF THE METALLURGICAL AND ECONOMICAL ASPECTS OF THIS PROCESS WITH THOSE OF CONVENTIONAL ELECTROSLAG WELDING.

APPENDIX C

GENERAL GUIDELINES FOR FITUP OF TEST ASSEMBLIES

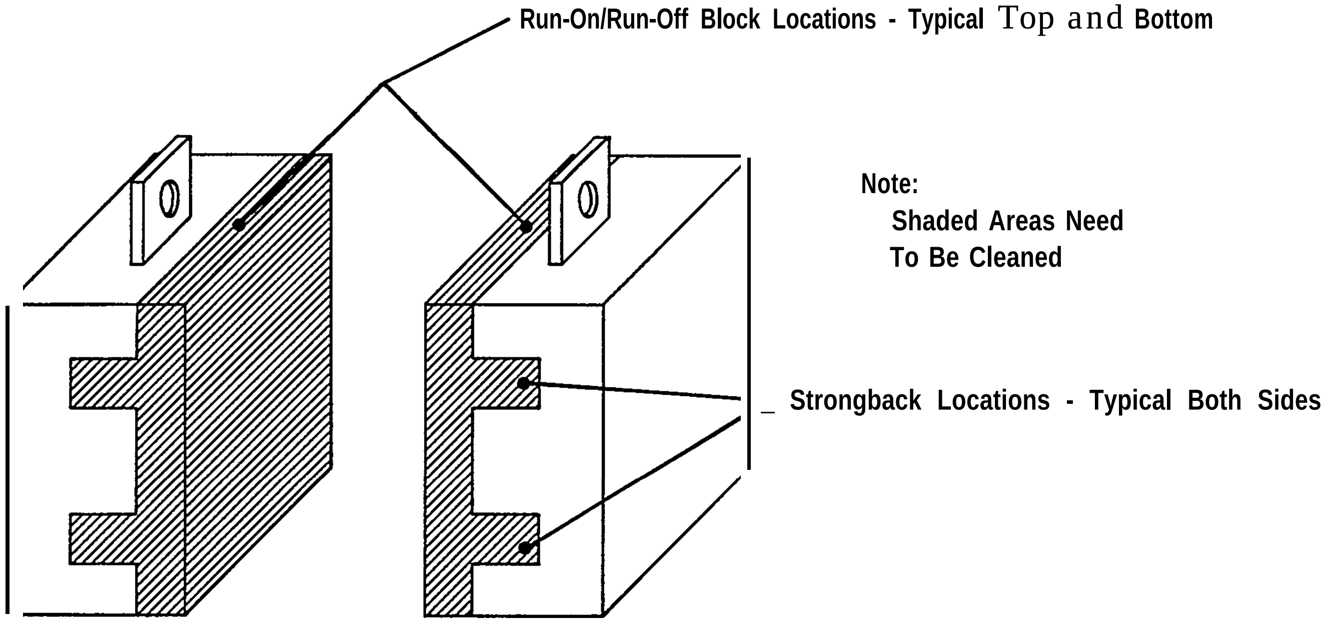


Figure C-1
Prepare Castings

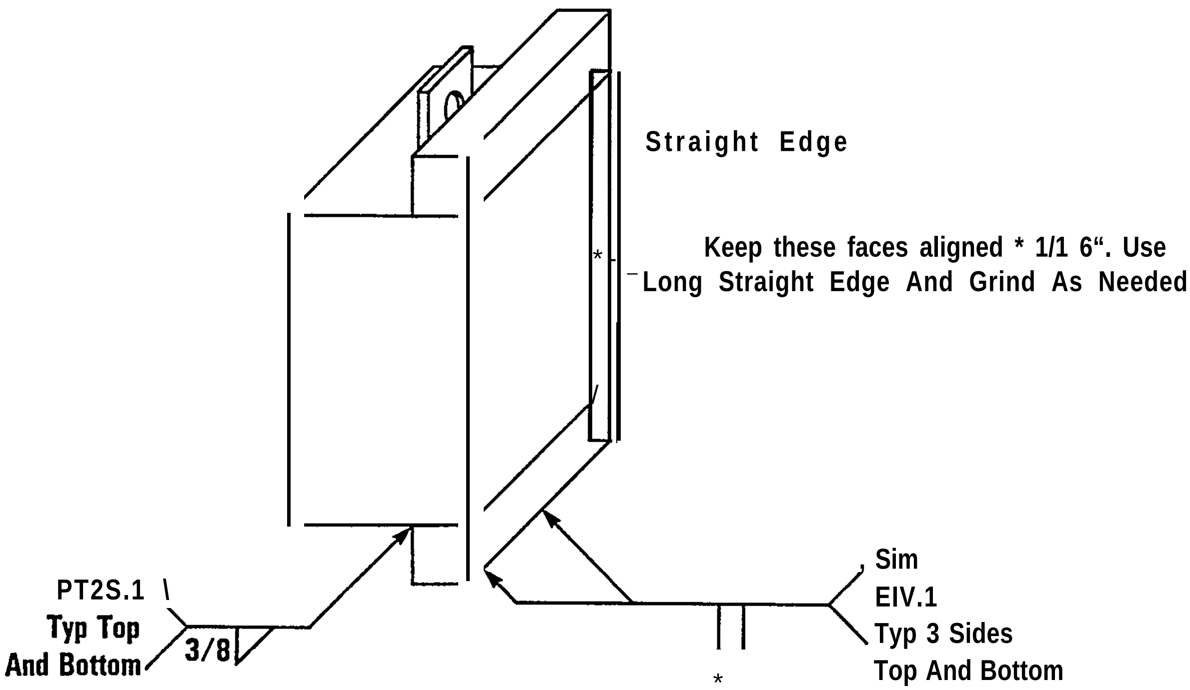


Figure C-2
Add Run-On/Run-Off Blocks
(Apply To Both Castings)

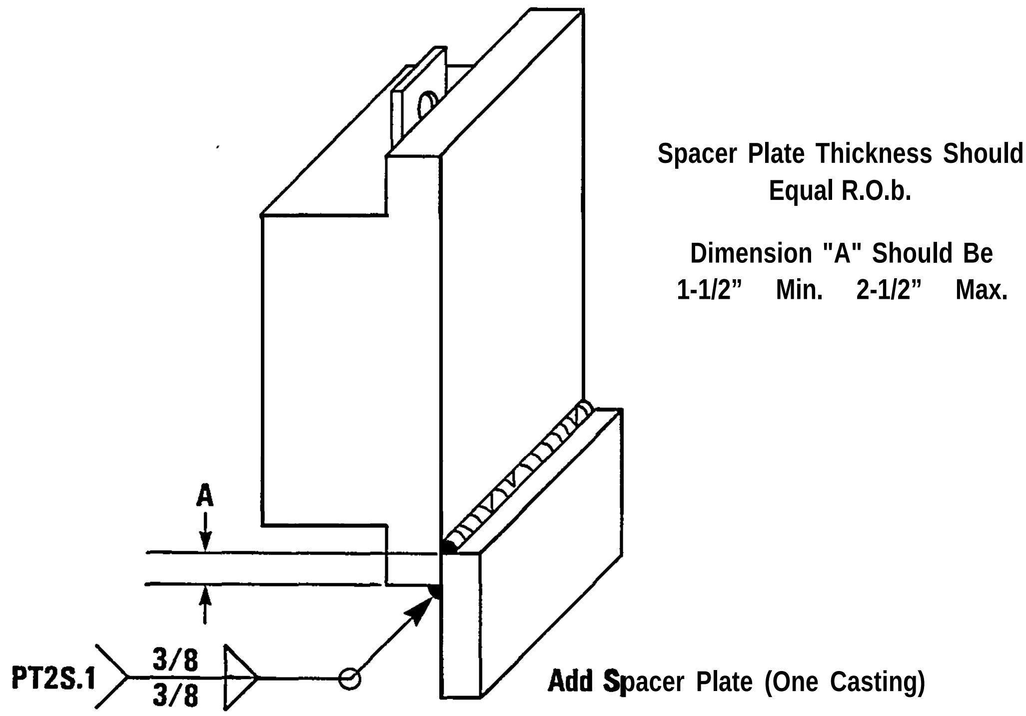
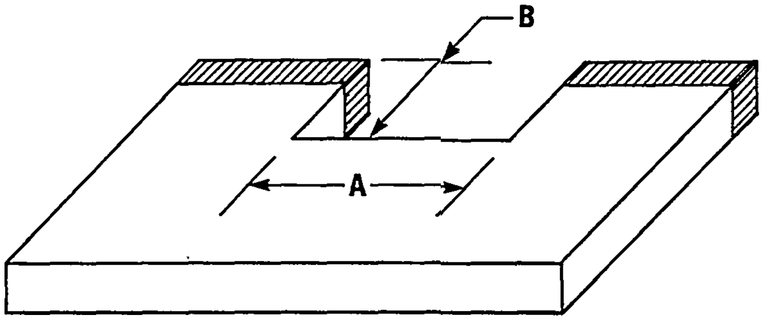


Figure C-3
Add Spacer Plate (One Casting)

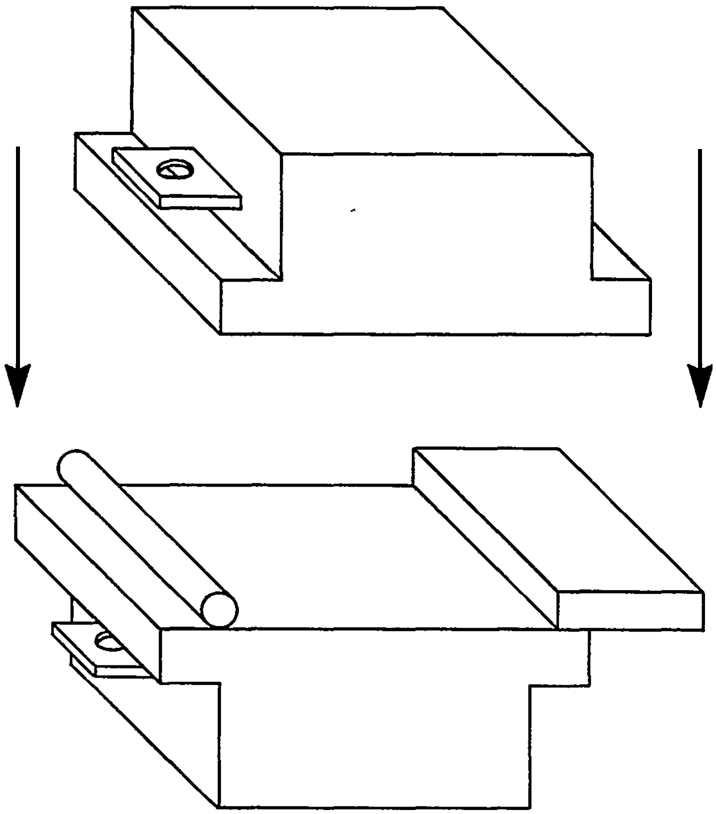


Note: Shaded Areas Need To Be Cleaned.

Dimension "A" Should Equal The Shoe Width Plus 1".

Dimension "B" Should Equal The Shoe Thickness Plus 1/2".

Figure C-4
Fabricate 4 Or 6 Strongbacks



Place The Casting With Separation Plate On An Assembly Platen. Insert A Pipe Or Round Bar As Shown. This Also Should Be Equal To R.O.B. Land The Top Casting Onto The Separation Plate With A Crane. Lower The End Until It Rests On The Pipe. Align The Castings, Keeping The Faces In The Proper Orientation. Use Wedges To Achieve R.O.t. Remove Pipe.

Figure C-5
Fit Castings Together

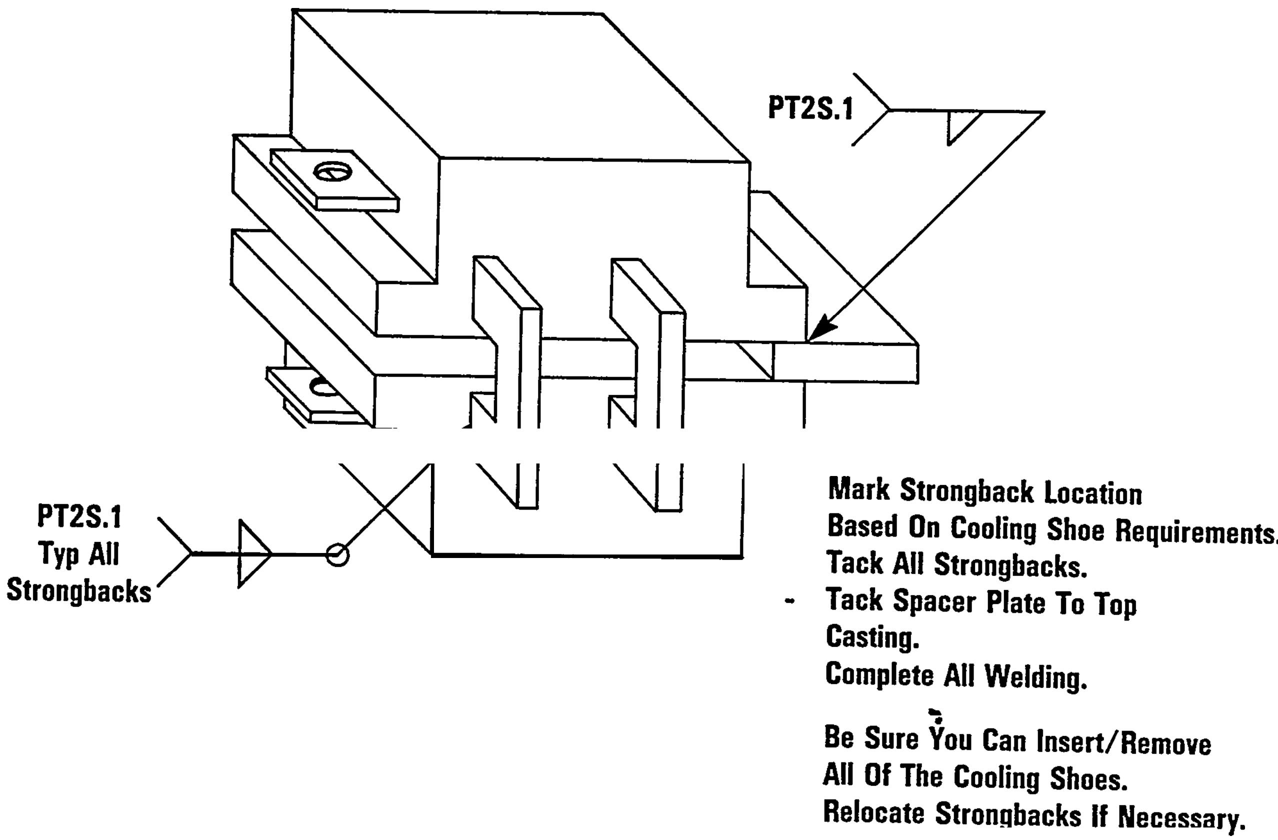


Figure C-6
Attach Strongbacks

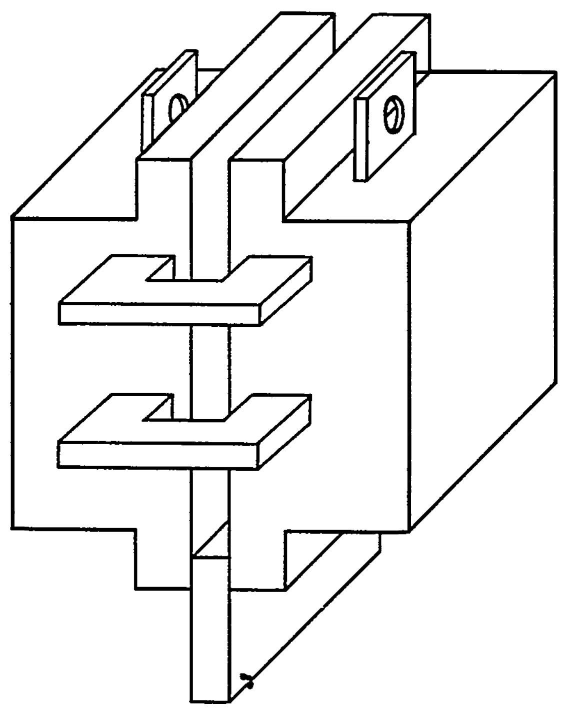
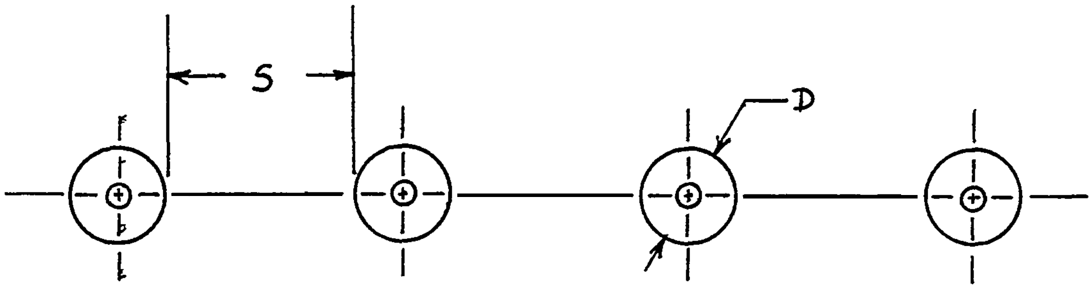


Figure C-7
Finished Test Assembly

To determine guide tube spacing., S, in inches from tube edge to tube edge:



$$S = \frac{T - N(D) - O}{N-1}$$

Where:

T = Thickness of joint in inches
N = Number of guide tubes
D = Outside diameter of guide tubes in inches
O = Oscillation amplitude in inches

For Example:

To weld a 12 3/4" thick joint using four 5/8" diameter guide tubes, and a 1-3/4" oscillation amplitude

$$S = \frac{12.75 - 4\ (.625) - 1.75}{3}$$

2.8, use 2-13/16"

Figure C-8

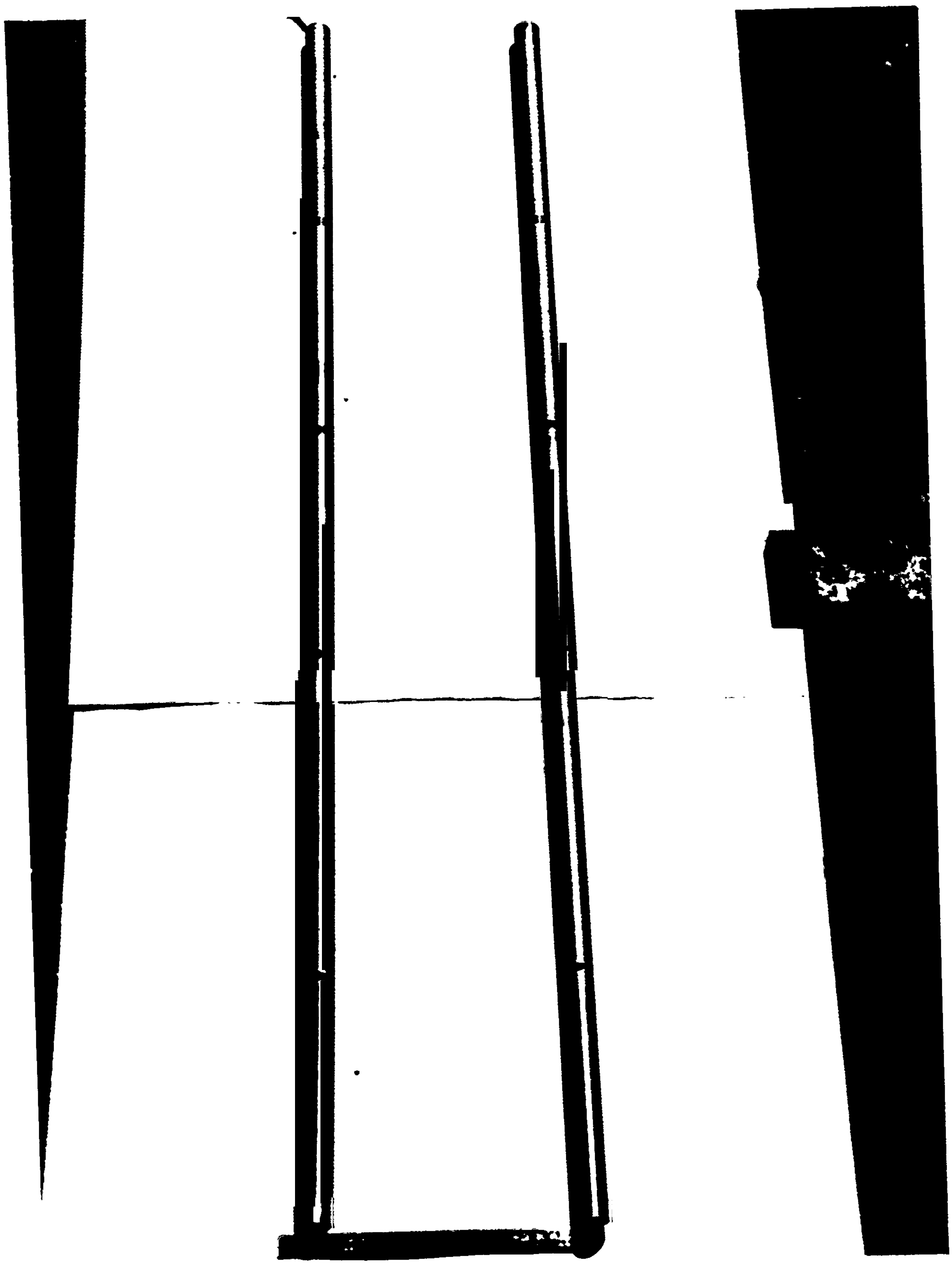


Figure C-9
Establishing Guide Tube **Spacing**

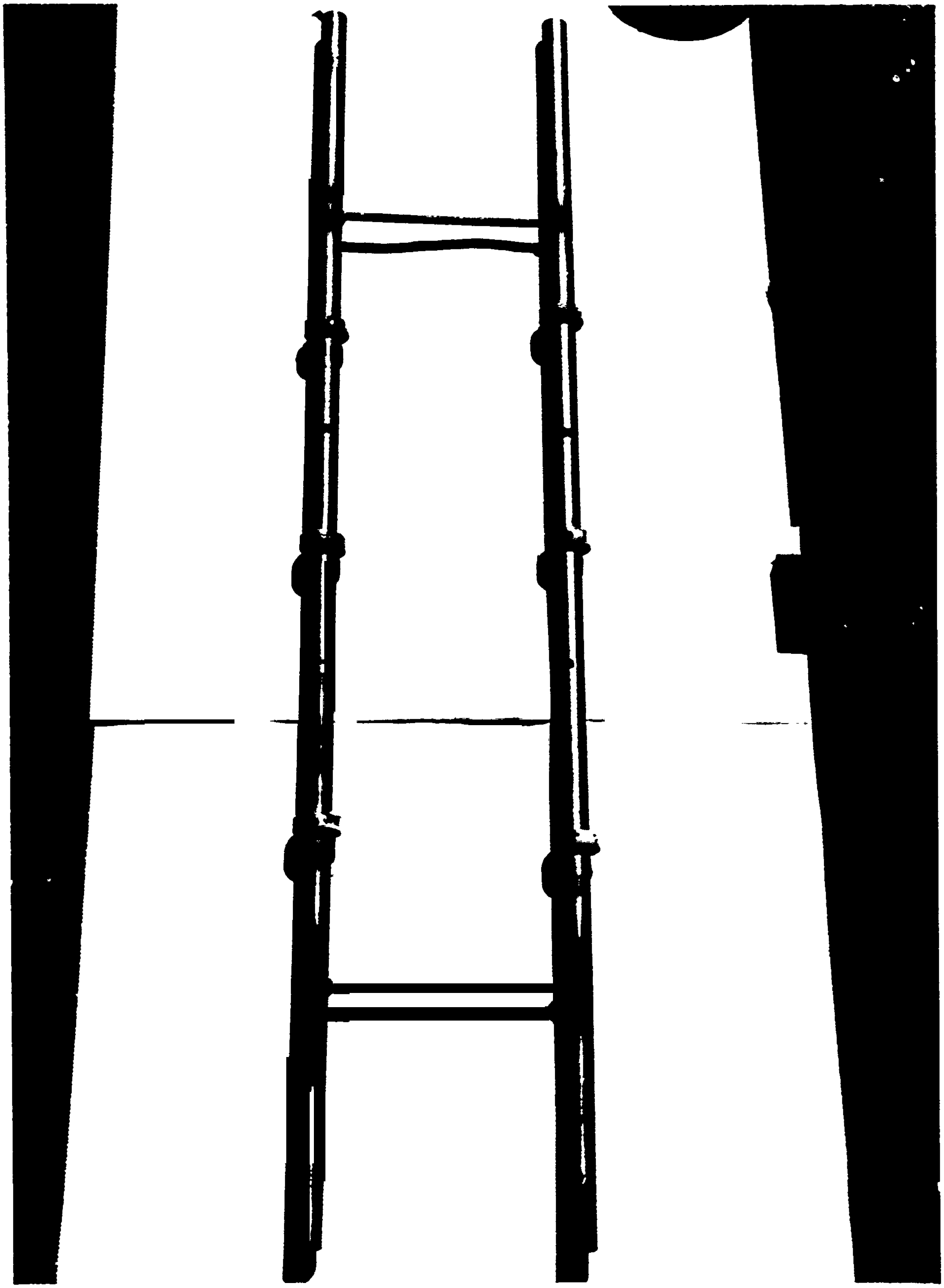


Figure C-10
Initial Fitup Of Guide Tubes

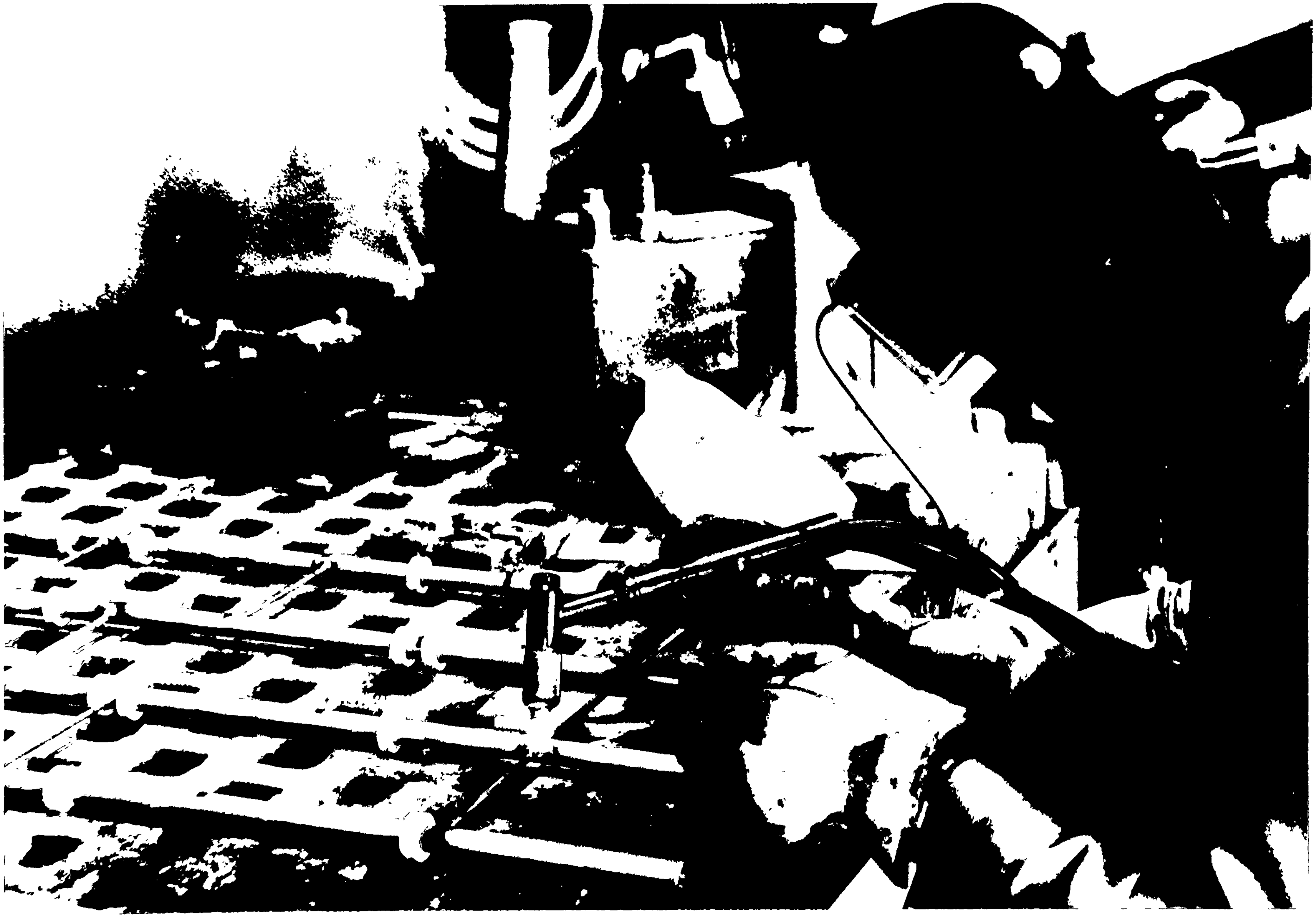


Figure C-11
Welder Tacking Spacers To Guide Tubes

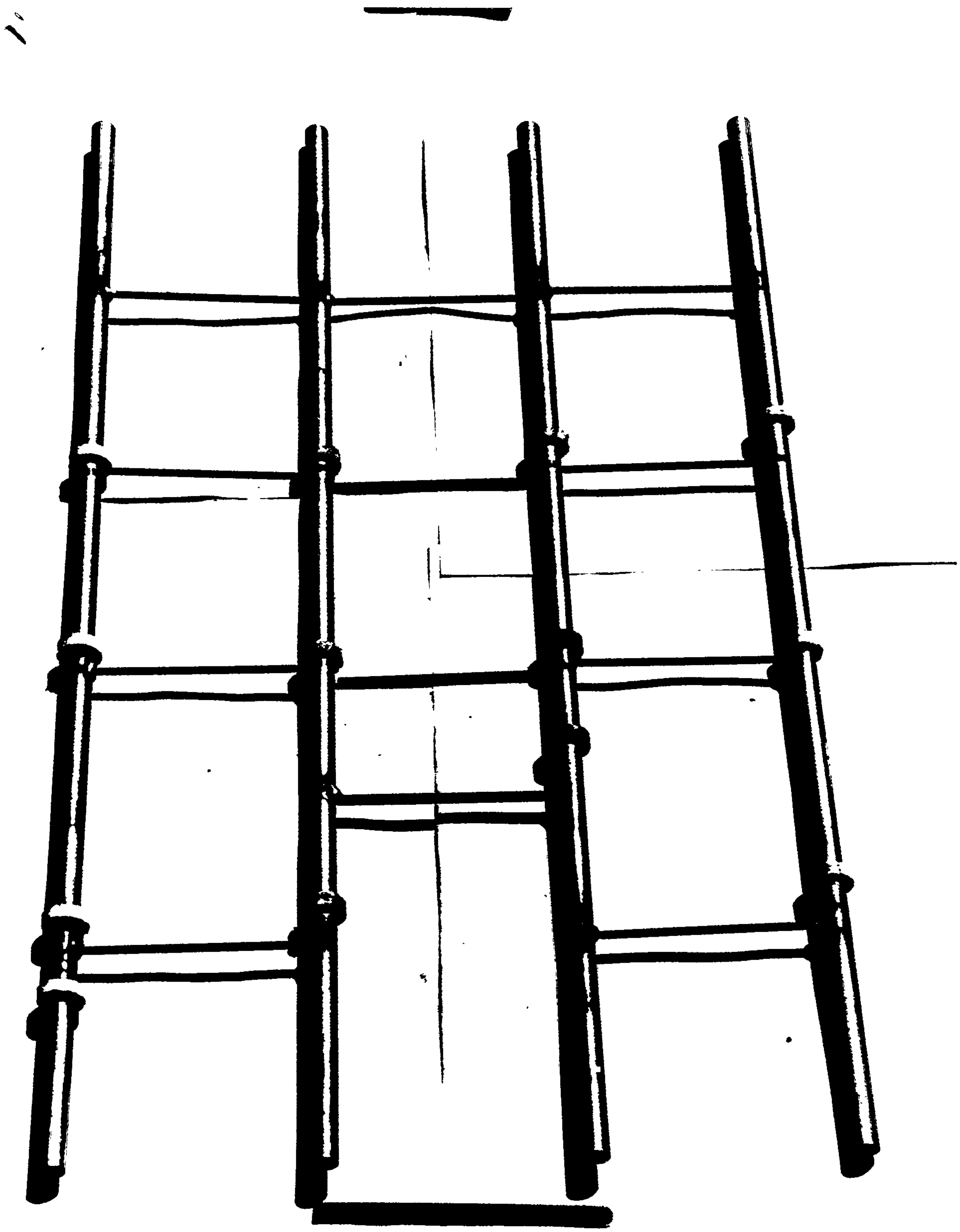


Figure C-12
Completed Guide Tube Rack

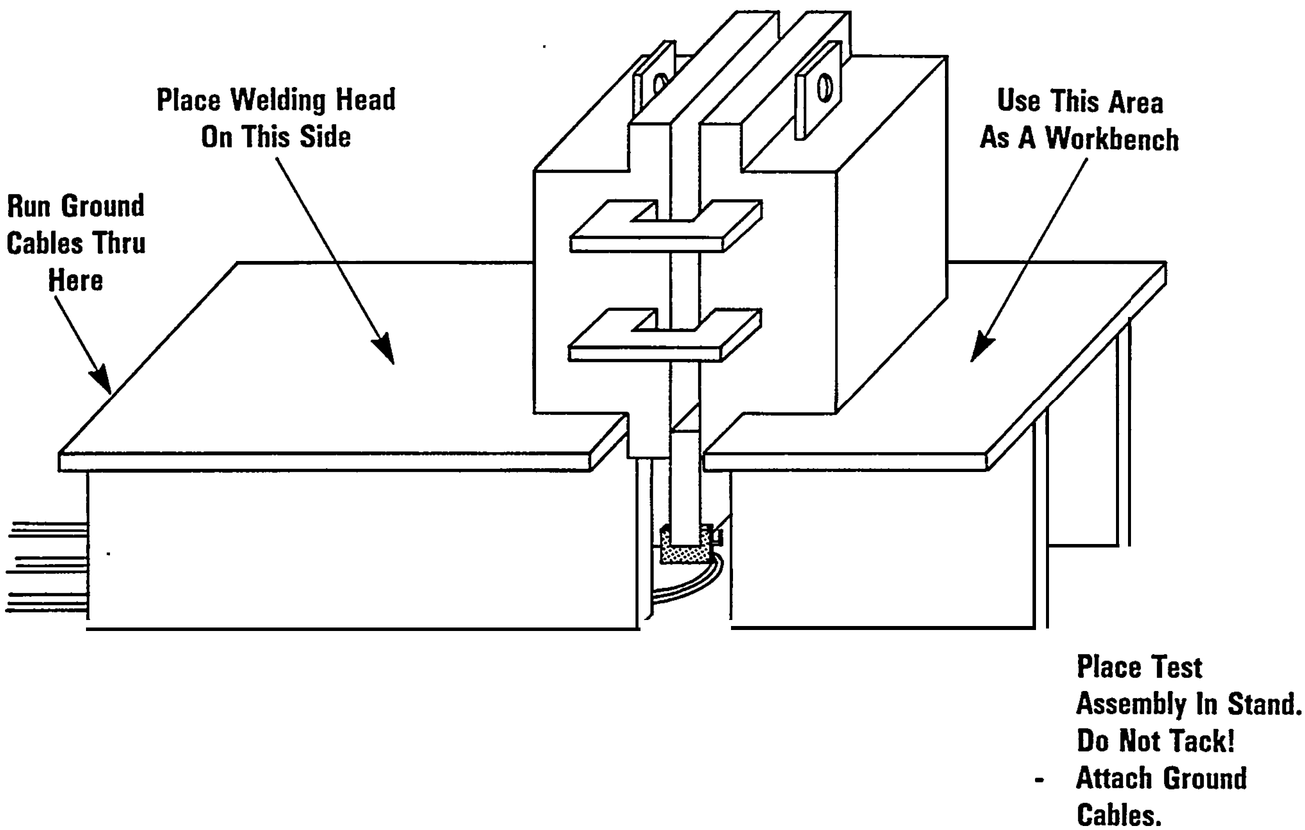


Figure C-13
Installing Test Assembly

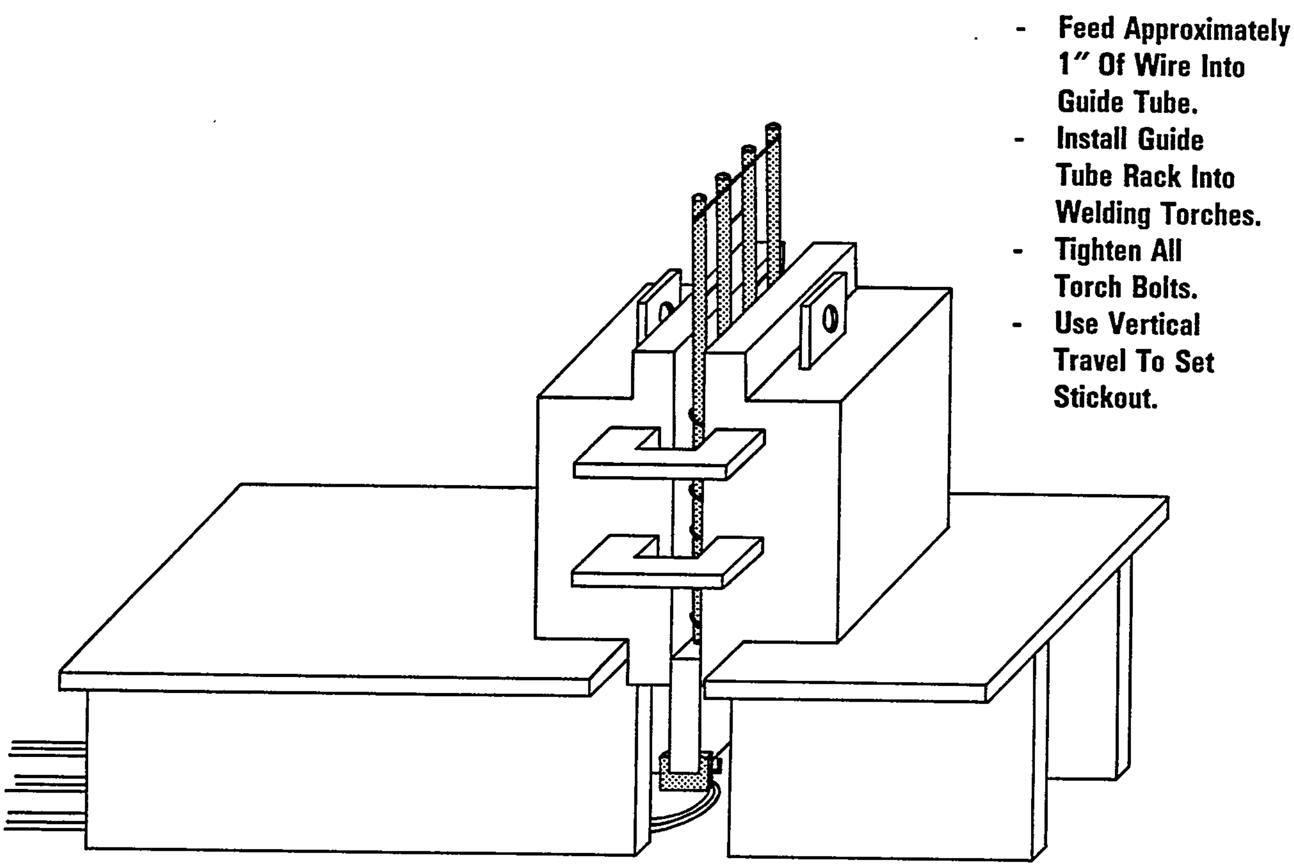
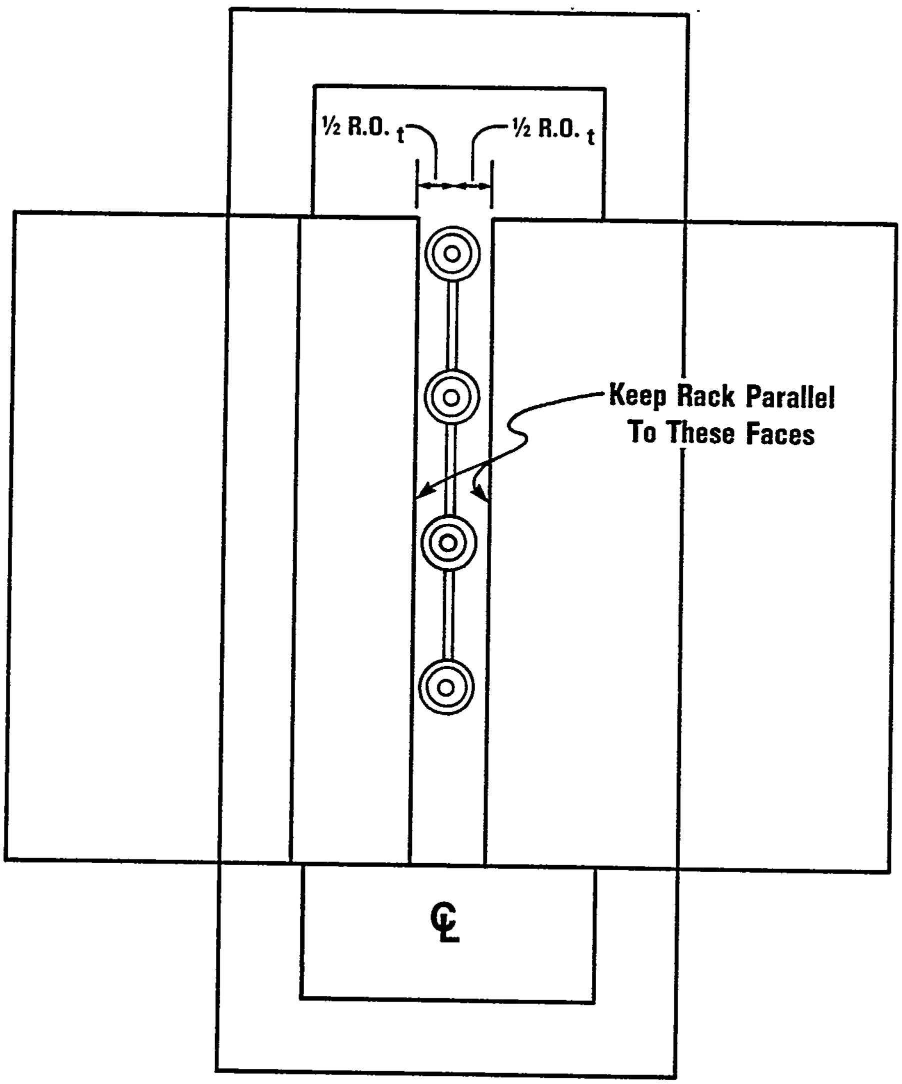


Figure C-14
Guide Tube Rack Installation



Guide Tube Rack Must Be Made Parallel To Joint Faces, Centered, And Aligned Vertically. Use Fine Adjustments On Welding Head To Control Rack Location. After Alignment Is Complete, Tighten The Welding Head Completely And Tack The Casting To The Stand. Check To Assure Rack Is Still Centered Between The Two Faces.

Figure C-15
Guide Tube Rack Alignment

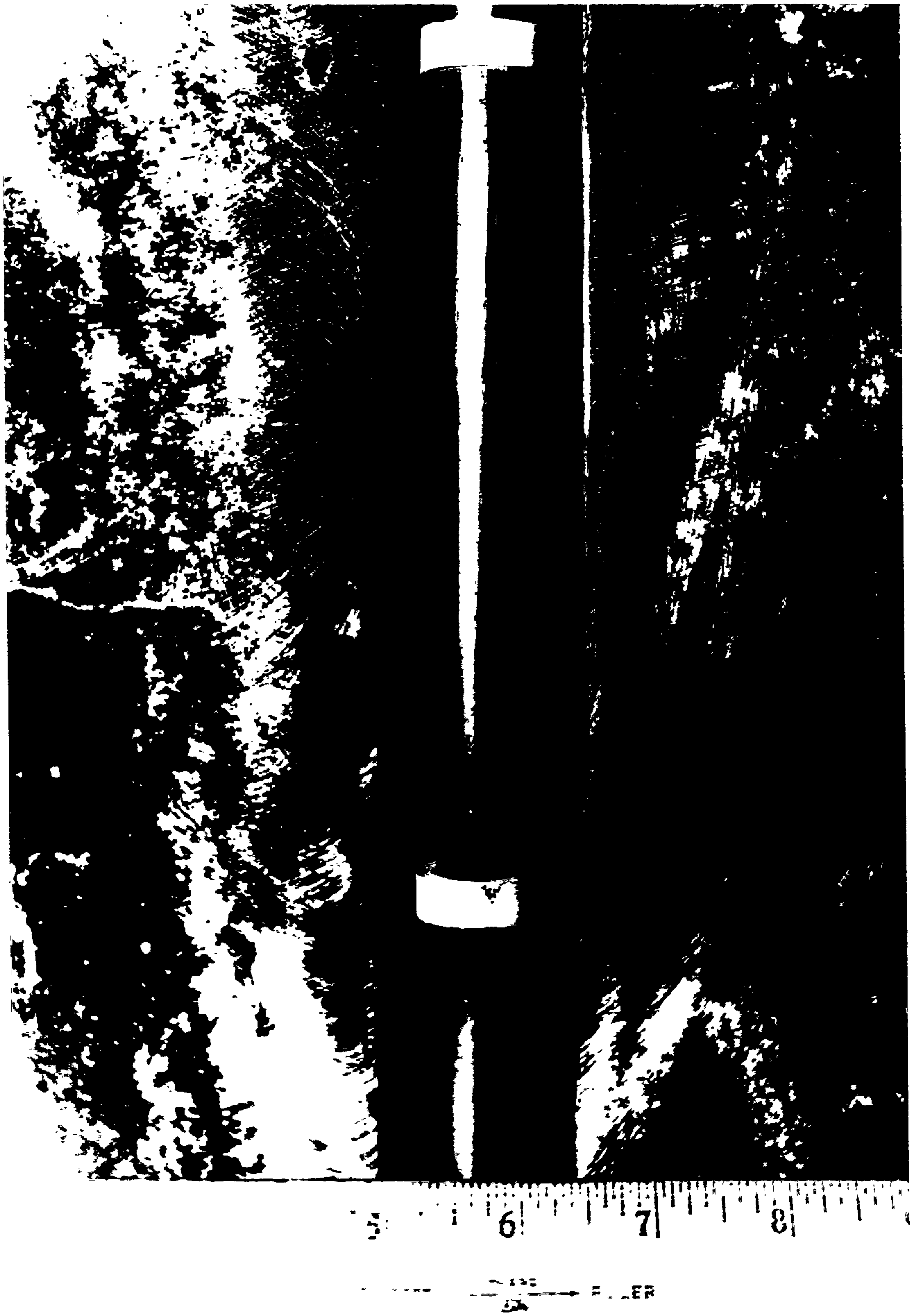
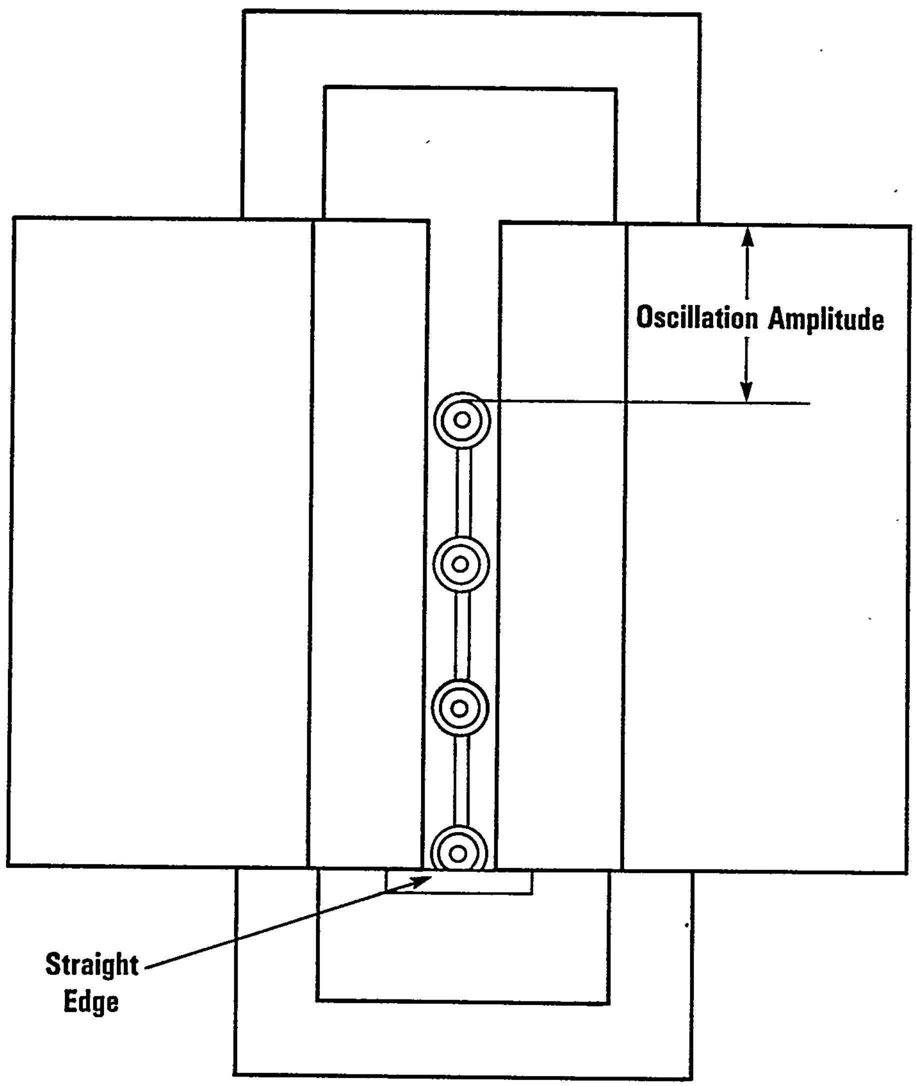


Figure C-16
Guide Tube Rack Installed In Joint — Side View



Move Rack To An Extreme Using The Oscillation Control Switch.
Using A Straight Edge (Away From An Insulator) Line Up The Guide Tube And Joint Sides.
Adjust The Limit Switch Stop As Needed.
Straight Edge Should Touch The Tube At Top And Bottom.
Measure And Record The Oscillation Amplitude.
Move Rack To Opposite Extreme.
Use The Straight Edge To Check That Side.
Adjust Limit Switch Stops As Needed.
Use Stopwatch To Set End Dwells.
Then Use The Oscillation Speed Control To Achieve The Proper Cycle Time.
(Cycle Time = 2 Dwells + 1 Traverse)

Figure C-17
Set Oscillation & Dwells

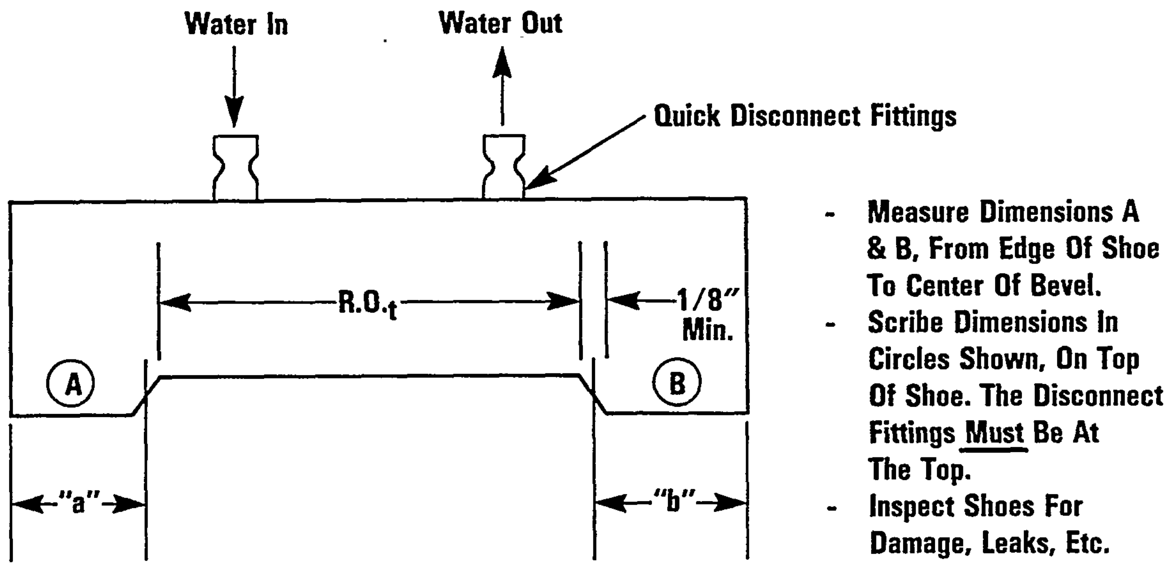
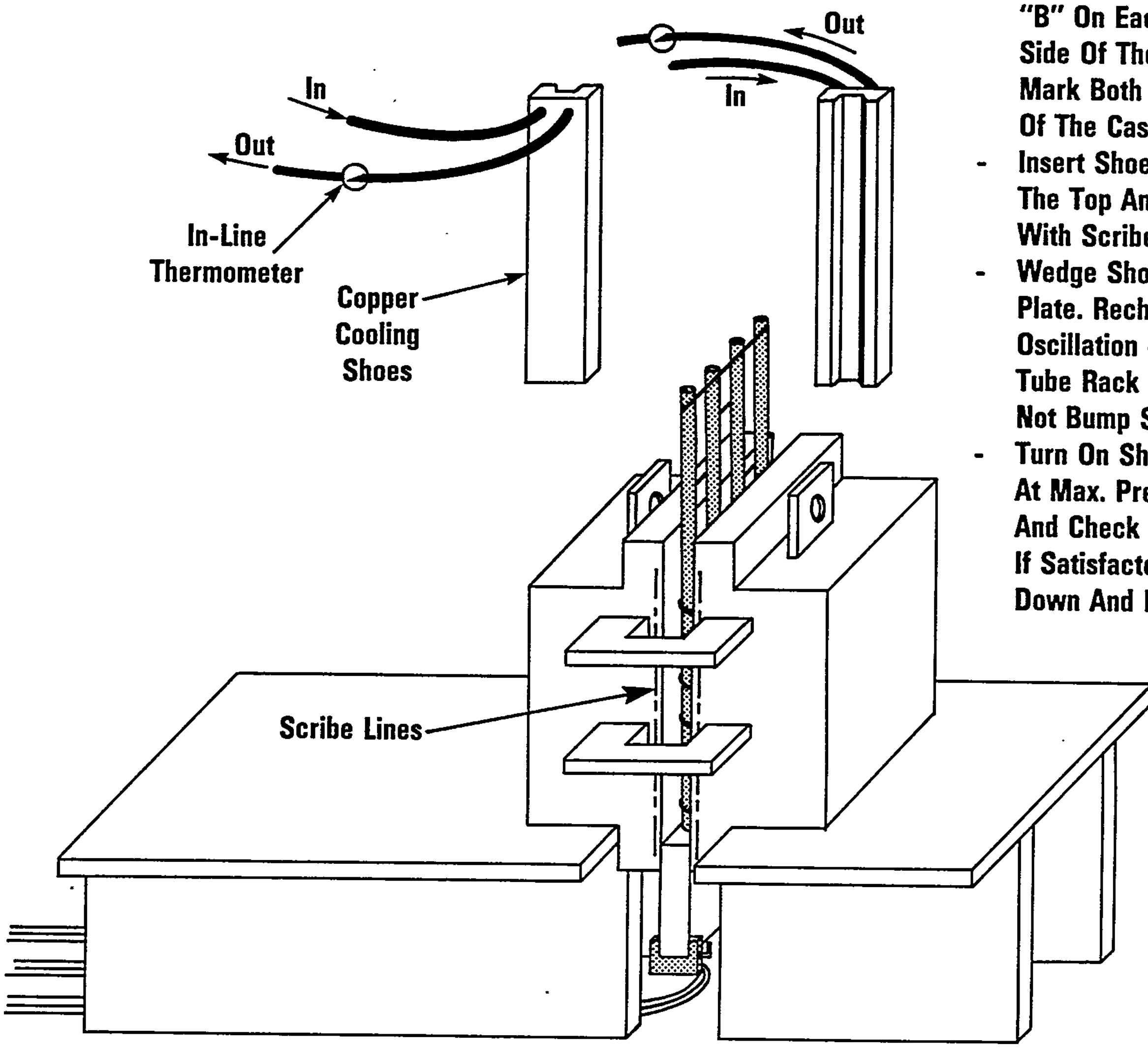


Figure C-18
Check & Measure Cooling Shoes



- Scribe Lines "A" & "B" On Each Side Of The Joint. Mark Both Sides Of The Casting.
- Insert Shoes From The Top And Align With Scribed Lines.
- Wedge Shoes In Plate. Recheck Oscillation - Guide Tube Rack Should Not Bump Shoes.
- Turn On Shoes At Max. Pressure And Check Operation. If Satisfactory, Shut Down And Remove Shoes.

Figure C-19
Install Cooling Shoes

To determine wire needs for a certain joint

(1) Width x Length x Thickness = Joint volume (in^3)

NOTE : Include run-on/run-off tabs in length

(2). Joint volume x .283 $\#/in^3$ = number of pounds of wire needed for the joint.

(3) Add 3 to 5 pounds as a safety factor.

(4) Divide the number of pounds required by the number of guide tubes.

For Example:

To weld a 10-3/4" thick, 26" long joint, with a nominal root opening of 1.25 using 3 guide tubes

10.75 x 26 x 1.25 = 350 in^3

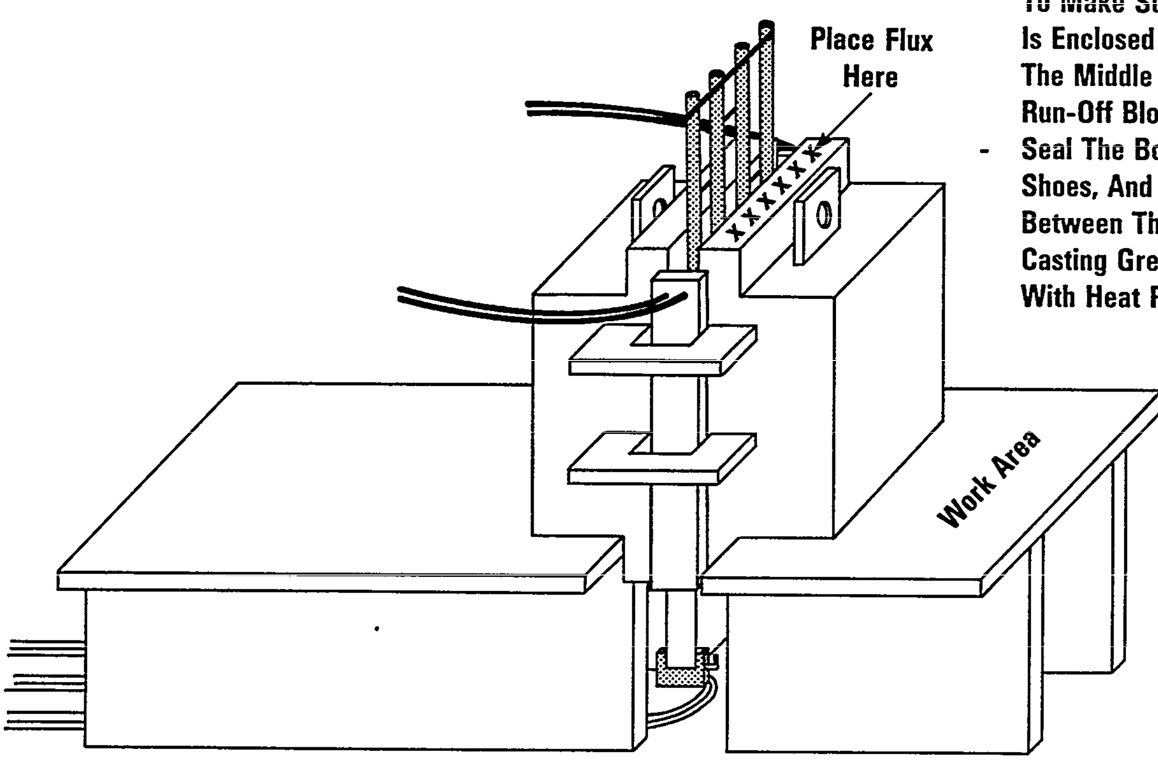
350 in^3 x .283 $\#/in^3$ = 99 lbs.

99 lbs + 5 = 104 lbs

104/3 = 35 pounds per roll

Determining Wire Needs
Figure C-20

- Center The Guide Tube Rack From Side-To-Side.
- Determine Wire Needs For Joint, From Figure C-20. Put Wire On Stand.
- Lower One Of The Center Wires Down, Into A 1" Ball Of Steel Wool. Lower All Other Wires Until They Are Recessed 1/8".
- Again Insert And Align The Cooling Shoes. Wedge Them Tightly Against Strongbacks. Use As Many Shoes As Necessary To Make Sure The Joint Is Enclosed At Least To The Middle Of The Run-Off Block.
- Seal The Bottom Of The Shoes, And Any Gaps Between The Shoes And Casting Greater Than 3/32" With Heat Resistant Putty.



- Attach Welding Mirrors To Torch Rack To Increase Puddle Visibility.
- Preheat Sump If Necessary.
- Attach Voltmeter And Arc Time Recorder.
- Place A Layer Of Flux Across The Front Run-Off Block. Keep Extra Flux, Burning Goggles, Stopwatch, Wrenches, Pliers, Etc. On The Work Area.
- Secure Area, Have Fire Extinguisher On Hand.

Figure C-21
Preparation For Welding

APPENDIX D

WELDING DATA SHEETS

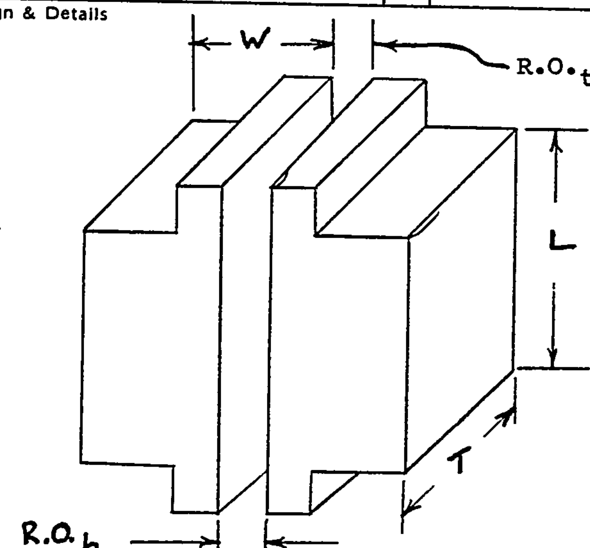
NOTE The use of various preheat temperatures during the project was for assuring moisture removal prior to welding, not for achieving certain heating/cooling rates.

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	2 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting	Preheat (min) 125°F; method Torch; measured by Tempstick
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator		PREHEAT SUMP AREA ONLY; Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018		1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 16"L x 12"W x 6"T; PO/Heat/Lot: ; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59; 5/8" Inside Diameter		FLUX: Brand/Type Linde 124/F74; Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type 24" Long/Copper; Flow N/R; Max Temp 190 °F	FINAL VISUAL: X Satisfactory ___ Visual Defects; Description: Good Appearance		FINAL RT: X Satisfactory; ___ Unsatisfactory; Procedure 0900-003-9000 CL 1

Joint Design & Details



R.O.$_t$ = 1-1/8" $^{+1/16"}_{-0}$

R.O.$_b$ = 1-1/8" $^{+1/16"}_{-0}$

GUIDE TUBE SPACING 3 1/8"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION: DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE
START	155 ipm	50 V	1-1/2 in.	450 A	3 sec.	12 sec.	5 cpm	1 3/4 in.
RUNNING	↓	↓		↓	↓	↓	↓	↓

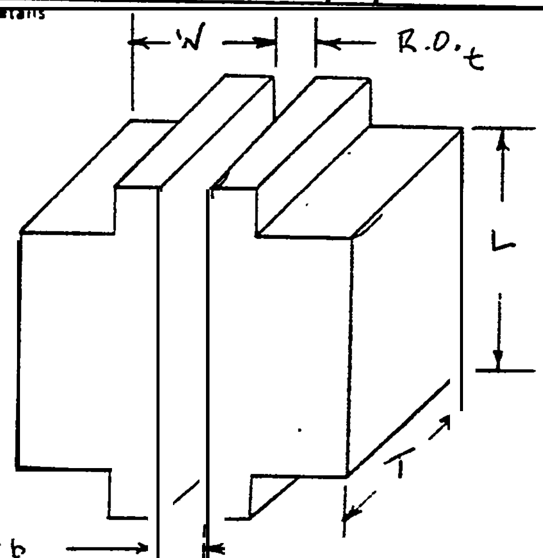
Technicians/SSN	Charge	Date	Joint No.
Spence	1026M-9	7/1/83	M685-1

ELECTROSLAG DATA SHEET

Newport News Shipbuilding

PROCESS	2 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	plate / X casting
Preheat (min)	175°F	method	Torch
measured by	Tempstick	PREHEAT SUMP AREA ONLY	Interpass N/A
EQUIPMENT	Power Supply: Hobart RC-1000 / Polarity: DCEP / Wire Feeder: Hobart	CONTROLS:	Hobart Multi-Torch Control Box / Hobart Multi-Wire Oscillator
FILLER MAT'L	Size/Type: 3/32" Dia./Solid Wire / Brand: Hobart 25-P / Specification:	5/8" Dia. Guide Tubes / Hobart Type No. 58 / ASTM A108 Gr. 1018	1/4" Dia. Round Bar / Commercial / ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 16"L x 12"W x 6"T / PO/Heat/Lot: N/R / Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59 / 5/8" Inside Diameter	FLUX: Brand/Type: Linde 124 & PF-2 / Storage: Flux oven @ 250°F, Remained warm to touch
SHOES	Size/Type: 24" Long/Copper / Flow: N/R / Max Temp: 180°F	FINAL VISUAL: X Satisfactory ___ Visual Defects / Description	FINAL RT: ___ Satisfactory ___ Unsatisfactory N/A / Procedure 0900-003-9000-Cl 1

Joint Design & Details



$R.O._t = 1\text{-}1/4" \ {}^{+\,1/16"}_{-\,0}$

$R.O._b = 1\text{-}1/16" \ {}^{+\,1/16}_{-\,0}$

GUIDE TUBE SPACING 3-1/8"

WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE
155 ipm	50 v	1-1/ in.	450 A	3	12 sec.	5 cpm	1-5/8 in

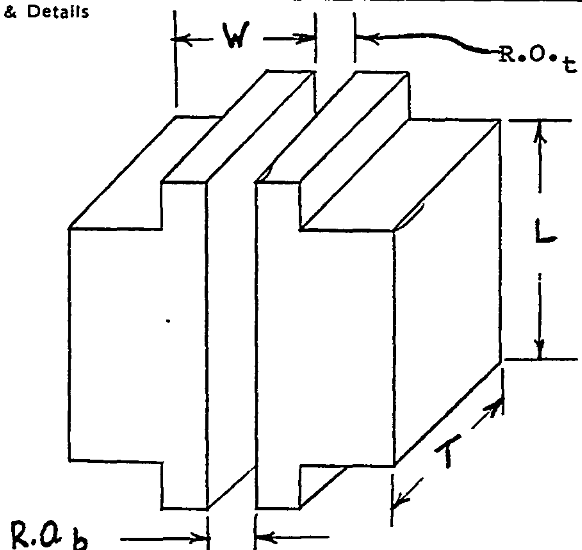
Technicians SS: Spence | Charge: 1026M-9 | Date: 7/7/83 | Joint No.: M685-2

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	1 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	X plate ___ casting
EQUIPMENT	Power Supply: Hobart RC-1000 Polarity: DCEP Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box Hobart Multi-Wire Oscillator	Preheat (min): 125°F method: Torch measured by: Tempstick PREHEAT SUMP AREA ONLY Interpass: N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire Brand: Hobart PS-588 Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes Hobart Type No. 58 ASTM A108 Gr. 1018	1/4" Dia. Round Bar Commercial ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 24"L x 12"W x 4"T PO/Heat/Lot: Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74 Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type 24" Long/Copper Flow N/R Max Temp 85/100 °F	FINAL VISUAL: X Satisfactory ___ Visual Defects Description: Good Appearance	FINAL RT: ___ Satisfactory N/A ___ Unsatisfactory Procedure

Joint Design & Details



R.O.$_t$ = 1-1/2" $^{+1/16"}_{-0}$

R.O.$_b$ = 1-1/4" $^{+1/16"}_{-0}$

GUIDE TUBE SPACING N/R

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION: DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE
START	155 ipm	49 V	1-1/2 in.	420 A	3 sec.	11 sec.	5 cpm	1 in.
RUNNING	175 ipm	47 V		420 A	↓	↓	↓	↓

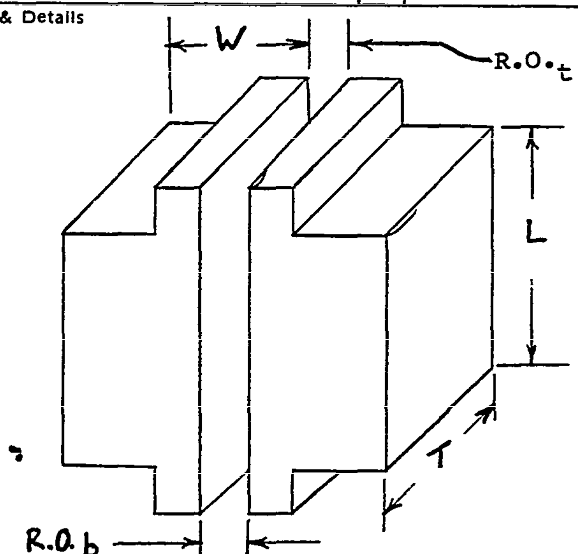
Technicians/SSN	Charge	Date	Joint No.
Byrd	1026M-9	11/9/83	M685-3

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	2 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	X plate ___ casting
Preheat (min)	125°F	method	Torch
measured by	Tempstick		
EQUIPMENT	Power Supply: Hobart RC-1000 Polarity: DCEP Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box Hobart Multi-Wire Oscillator	PREHEAT SUMP AREA ONLY Interpass: N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire Brand: Hobart PS-588 Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes Hobart Type No. 58 ASTM A108 Gr. 1018	1/4" Dia. Round Bar Commercial ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 24"L x 12"W x 4"T PO/Heat/Lot: Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74 Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type: 24" Long/Copper Flow: N/R Max Temp: 125/100 °F	FINAL VISUAL: X Satisfactory ___ Visual Defects Description: Good Appearance	FINAL RT: ___ Satisfactory X Unsatisfactory Procedure 0900-003-9000 CL 1

Joint Design & Details



$R.O._t = 1\text{-}3/8" \begin{smallmatrix}+\\-\end{smallmatrix} \begin{smallmatrix}1/16"\\0\end{smallmatrix}$

$R.O._b = 1\text{-}1/4" \begin{smallmatrix}+\\-\end{smallmatrix} \begin{smallmatrix}1/16"\\0\end{smallmatrix}$

GUIDE TUBE SPACING N/R

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION			
					DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE
START	155 ipm	50 V	1-1/2 in.	425 A	3 sec.	11 sec.	5 cpm	1 in.
RUNNING	170-175 ipm	45 V		420 A				

Technicians/SSN	Charge	Date	Joint No.
Byrd	1026M-9	11/16"/83	M685-4

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS: 3 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING

POSITION: VERTICAL UP

___ plate
X casting

Preheat (min) 125°F
method Torch
measured by Tempstick
PREHEAT SUMP AREA ONLY
Interpass N/A

EQUIPMENT

Power Supply: Hobart RC-1000
Polarity: DCEP
Wire Feeder: Hobart

CONTROLS:
Hobart Multi-Torch Control Box
Hobart Multi-Wire Oscillator

FILLER MAT'L

	Wire	Guide Tubes	Round Bar
Size/Type	3/32" Dia./Cored Wire	5/8" Dia. Guide Tubes	1/4" Dia. Round Bar
Brand	Hobart PS-588	Hobart Type No. 58	Commercial
Specification	EWT2 (AWS 5.25-78)	ASTM A108 Gr. 1018	ASTM A108 Gr. 1018

BASE MAT'L

Dimensions: 13"L x 8"W x 8"T
PO/Heat/Lot:
Specification: MIL-S-15083 Gr. B

INSULATOR: Hobart Type No. 59
5/8" Inside Diameter

FLUX: Brand/Type Linde 124/F74
Storage Flux oven @ 250°F, Remained warm to touch

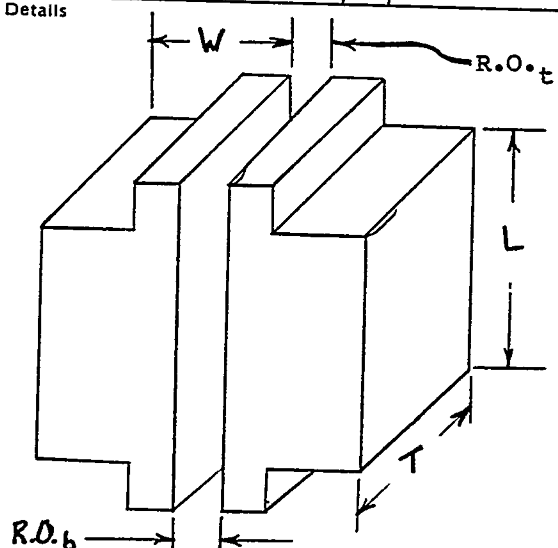
COOLING SHOES

Size/Type 24" Long/Copper
Flow N/R
Max Temp 105/90 °F

FINAL VISUAL: ___ Satisfactory X Visual Defects
Description LOF on Side 2 was repaired

FINAL RT: X Satisfactory
___ Unsatisfactory
Procedure 0900-003-9000 CL 1

Joint Design & Details



$R.O._t = 1\text{-}1/4" \; {}^{+}_{-} \; {}^{1/16"}_{0}$

$R.O._b = 1\text{-}1/8" \; {}^{+}_{-} \; {}^{1/16"}_{0}$

GUIDE TUBE SPACING N/R

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	OSCILLATION CYCLE TIME	OSCILLATION FREQUENCY	OSCILLATION AMPLITUDE
START	155 ipm	50 V	1-1/2 in.	400 A	3 sec.	11 sec.	5 cpm	5/8 in.
RUNNING	175-200 ipm	40 V		400 A				

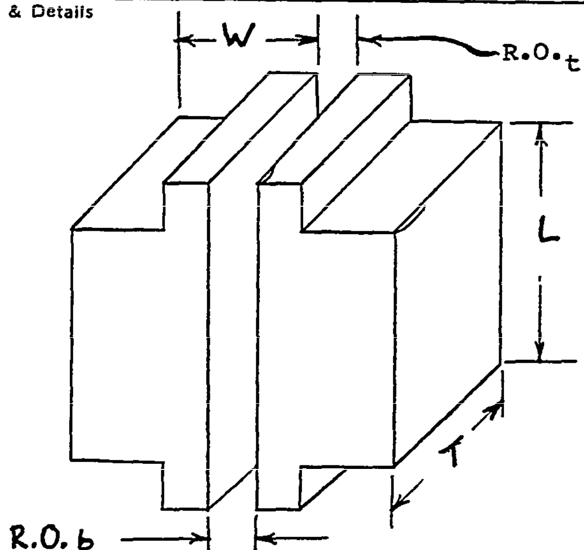
Technicians/SSN: Byrd
Charge: 1026M-9
Date: 1/31/84
Joint No. M685-5

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	3 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	plate; X casting	Preheat (min) 125°F; method Torch; measured by Tempstick
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator		PREHEAT SUMP AREA ONLY; Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018	1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018	
BASE MAT'L	Dimensions: 14"Lx8"Wx10-3/4"T; PO/Heat/Lot: ; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59; 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74; Storage Flux oven @ 250°F, Remained warm to touch	
COOLING SHOES	Size/Type: 24" Long/Copper; Flow: N/R; Max Temp: 115/90 °F	FINAL VISUAL: Satisfactory X; Visual Defects; Description: 4" ~~Long~~ LOF on Side 2 was repaired	FINAL RT: X Satisfactory; Unsatisfactory; Procedure 0900-003-9000 CL 1	

Joint Design & Details



$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING N/R

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	160 ipm	55 V	1-1/2 in.	425 A	3 sec.	11 sec.	5 cpm	2 in.	No spacers were used between the guide tubes.
RUNNING	145-150 ipm	47 V		385-400 A					Final Flux Depth = 1-1/2"

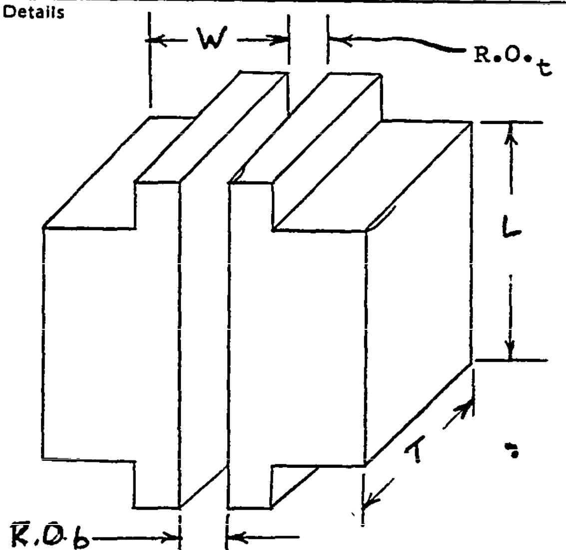
Technicians/SSN	Charge	Date	Joint No.
Byrd	1026M-9	2/17/84	M685-6

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION	VERTICAL UP	___ plate X casting	Preheat (min) 125°F method Torch measured by Tempstick
EQUIPMENT	Power Supply: Hobart RC-1000 Polarity: DCEP Wire Feeder: Hobart	CONTROLS:	Hobart Multi-Torch Control Box Hobart Multi-Wire Oscillator		PREHEAT SUMP AREA ONLY Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire Brand: Hobart PS-588 Specification: EWT2 (AWS 5.25-78)		5/8" Dia. Guide Tubes. Hobart Type No. 58 ASTM A108 Gr. 1018		1/4" Dia. Round Bar Commercial ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 16"L x 9"W x 13"T PO/Heat/Lot: Specification: MIL-S-15083 Gr. B	INSULATOR	Hobart Type No. 59 5/8" Inside Diameter	FLUX	Brand/Type Linde 124/F74 Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type: 24" Long/Copper Flow: N/R Max Temp: 170 °F	FINAL VISUAL	___ Satisfactory X Visual Defects Description LOF Both Sides App 3/8" Deep, Full Length	FINAL RT	___ Satisfactory ___ Unsatisfactory N/A Procedure

Joint Design & Details



$$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$$

$$R.O._b = 1\text{-}1/8" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$$

GUIDE TUBE SPACING N/R

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION: DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	155 ipm	55 V	1-1/2 in.	385-450 A	3 sec.	11 sec.	5 cpm	2 in.	Used one water cooler
RUNNING	155 ipm	50 V	—	400-425 A	↓	↓	↓	↓	
RUNNING	165 ipm	48 V	—	400-425 A					

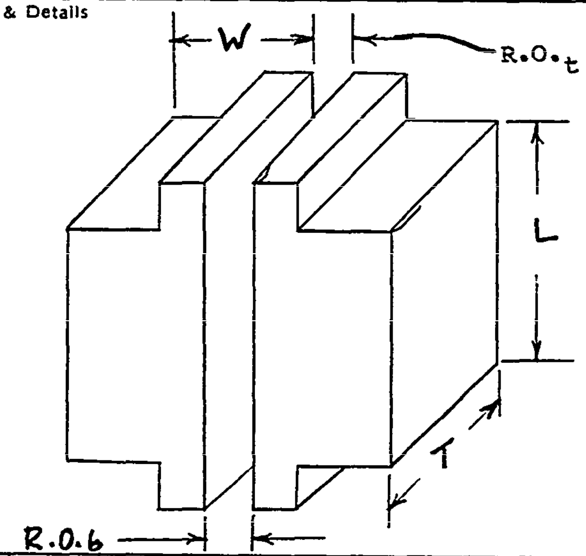
Technicians/SSN	Charge	Date	Joint No.
Byrd	1026M-9	3/23/84	M685-7

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate, X casting	Preheat (min) 125°F; method Torch; measured by Tempstick
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator		PREHEAT SUMP AREA ONLY; Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018	1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018	
BASE MAT'L	Dimensions: 12"Lx12"Wx13-3/4"T; PO/Heat/Lot: ; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59; 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74; Storage Flux oven @ 250°F, Remained warm to touch	
COOLING SHOES	Size/Type 24" Long/Copper; Flow N/R; Max Temp 115 °F	FINAL VISUAL: ___ Satisfactory X Visual Defects; Description LOF on both sides Full Length	FINAL RT: ___ Satisfactory N/A; ___ Unsatisfactory; Procedure	

Joint Design & Details



$R.O._t = 1\text{-}1/4'' \; {}^{+1/16''}_{-0}$

$R.O._b = 1\text{-}1/8'' \; {}^{+1/16''}_{-0}$

GUIDE TUBE SPACING N/R

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	OSCILLATION CYCLE TIME	OSCILLATION FREQUENCY	OSCILLATION AMPLITUDE	
START	140 ipm	55 V	1-1/2 in.	385 A	4 sec.	13 sec.	4 cpm	2 1/8 in.	Used one water cooler
RUNNING	150 ipm	53 V		385 A	↓	↓	↓	↓	

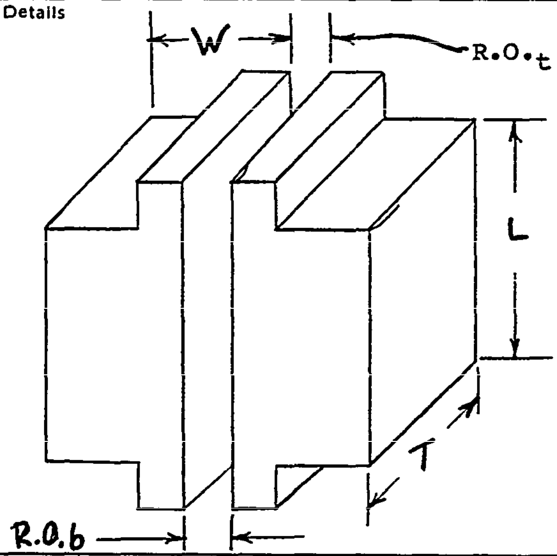
Technicians/SSN	Charge	Date	Joint No.
Byrd	1026M-9	4/4/84	M685-8

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting
		Preheat (min) 125°F; method Torch; measured by Tempstick	
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator	PREHEAT SUMP AREA ONLY; Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018	1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 10"Lx12"Wx13-3/4"T; PO/Heat/Lot: ; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59; 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74; Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type 24" Long/Copper; Flow N/R; Max Temp 130 °F	FINAL VISUAL: Satisfactory X Visual Defects; Description LOF on Both Sides Full length	FINAL RT: Satisfactory ___; Unsatisfactory ___ N/A; Procedure

Joint Design & Details



$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}1/8" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING N/R

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	150 ipm	54 V	1-1/2 in.	385 A	4 sec.	13 sec.	4 cpm	1 5/8 in.	Used one water cooler
RUNNING	155 ipm	54 V		390 A	↓	↓	↓	↓	After weld was complete, flow was checked- greater than 3 GPM

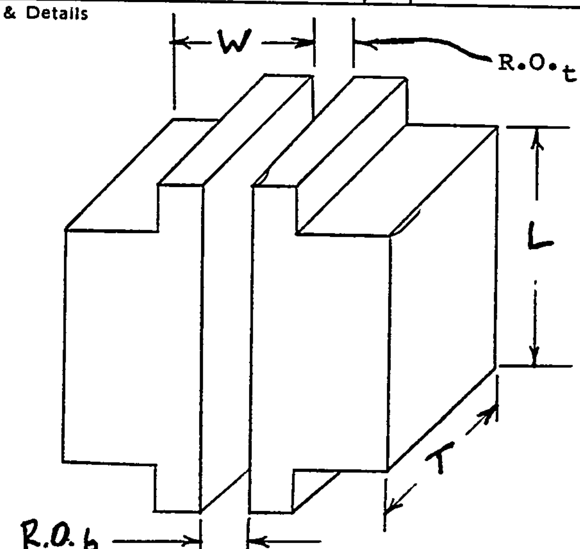
Technicians/SSN	Charge	Date	Joint No.
Byrd	1026M-9	4/6/84	M685-9

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	3 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION	VERTICAL UP	___ plate X casting	Preheat (min) 125°F method Torch measured by Tempstick
EQUIPMENT	Power Supply: Hobart RC-1000 Polarity: DCEP Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box Hobart Multi-Wire Oscillator			PREHEAT SUMP AREA ONLY Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire Brand: Hobart PS-588 Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes Hobart Type No. 58 ASTM A108 Gr. 1018			1/4" Dia. Round Bar Commercial ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 13"L x 12"W x 8"T PO/Heat/Lot: Specification: MIL-S-15083 Gr. B	INSULATOR	Hobart Type No. 59 5/8" Inside Diameter	FLUX	Brand/Type Linde 124/F74 Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type 24" Long/Copper Flow N/R Max Temp 125 °F	FINAL VISUAL	X Satisfactory ___ Visual Defects Description Good Appearance	FINAL RT	X Satisfactory ___ Unsatisfactory Procedure 0900-003-9000 CL 1

Joint Design & Details



$R.O._t = 1\text{-}1/4" \ {}^{+\,1/16"}_{-\,0}$

$R.O._b = 1\text{-}1/8" \ {}^{+\,1/16"}_{-\,0}$

GUIDE TUBE SPACING N/R

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	160 ipm	55 V	1-1/2 in.	395-400 A	4 sec.	13 sec.	4 cpm	1 5/8 in.	Joint was re-started after having trouble with wire stoppage Used one water cooler
RUNNING	160 ipm	55 V		395-400 A					
	160 ipm	50 V		390-395 A					

Technicians/SSN	Charge	Date	Joint No.
Byrd	1026M-9	4/20/84	M685-10

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS: 3 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING

POSITION: VERTICAL UP

___ plate
X casting

Preheat (min) 125°F
method Torch
measured by Tempstick

. PREHEAT SUMP AREA ONLY
Interpass N/A

EQUIPMENT
Power Supply: Hobart RC-1000
Polarity: DCEP
Wire Feeder: Hobart

CONTROLS:
Hobart Multi-Torch Control Box
Hobart Multi-Wire Oscillator

FILLER MAT'L

Size/Type	3/32" Dia./Cored Wire	5/8" Dia. Guide Tubes	1/4" Dia. Round Bar
Brand	Hobart PS-588	Hobart Type No. 58	Commercial
Specification	EWT2 (AWS 5.25-78)	ASTM A108 Gr. 1018	ASTM A108 Gr. 1018

BASE MAT'L
Dimensions: 13"Lx9"Wx10-3/4"T
PO/Heat/Lot:
Specification: MIL-S-15083 Gr. B

INSULATOR: Hobart Type No. 59
5/8" Inside Diameter

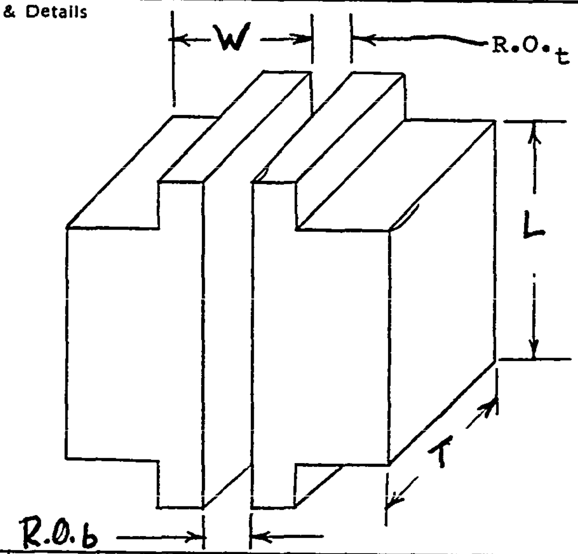
FLUX
Brand/Type: Linde 124/F74
Storage: Flux oven @ 250°F, Remained warm to touch

COOLING SHOES
Size/Type: 24" Long/Copper
Flow: N/R
Max Temp: 130 °F

FINAL VISUAL
X Satisfactory
Visual Defects
Description: <1/16" Undercut Approx. 1" Long

FINAL RT
X Satisfactory
Unsatisfactory
Procedure: 0900-003-9000 CL 1

Joint Design & Details



R.O.$_t$ = 1-1/4" $^{+1/16"}_{-0}$

R.O.$_b$ = 1-1/8" $^{+1/16"}_{-0}$

GUIDE TUBE SPACING N/R

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	OSCILLATION CYCLE TIME	OSCILLATION FREQUENCY	OSCILLATION AMPLITUDE	
START	160 ipm	55 V	1-1/2 in.	400 A	390-4 sec.	13 sec.	4 cpm	1 5/8 in.	Used one water cooler
RUNNING	155 ipm	50 V		380-390 A	↓	↓	↓	↓	

Technicians/SSN: Byrd
Charge: 1026M-9
Date: 5/23/84
Joint No.: M885-11

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	3 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting
Preheat (min)	125°F	method / measured by	Torch Tempstick

PREHEAT SUMP AREA ONLY

Interpass N/A

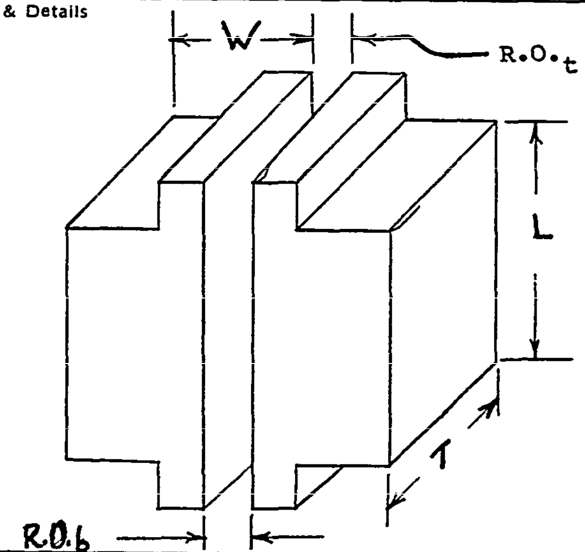
EQUIPMENT			
Power Supply	Hobart RC-1000	CONTROLS:	Hobart Multi-Torch Control Box
Polarity	DCEP		Hobart Multi-Wire Oscillator
Wire Feeder	Hobart		

FILLER MAT'L			
Size/Type	3/32" Dia./Cored Wire	5/8" Dia. Guide Tubes	1/4" Dia. Round Bar
Brand	Hobart PS-588	Hobart Type No. 58	Commercial
Specification	EWT2 (AWS 5.25-78)	ASTM A108 Gr. 1018	ASTM A108 Gr. 1018

BASE MAT'L		INSULATOR	FLUX
Dimensions	13"Lx9"Wx10-3/4"T	Hobart Type No. 59	Brand/Type Linde 124/F74
PO/Heat/Lot		5/8" Inside Diameter	Storage Flux oven @ 250°F,
Specification	MIL-S-15083 Gr. B		Remained warm to touch

COOLING SHOES		FINAL VISUAL	FINAL RT
Size/Type	24" Long/Copper	X Satisfactory ___ Visual Defects	X Satisfactory
Flow	N/R	Description	___ Unsatisfactory
Max Temp	130 °F	Good Appearance	Procedure 0900-003-9000 CL 1

Joint Design & Details



R.O.$_t$ = 1-1/4" $^{+1/16"}_{-0}$

R.O.$_b$ = 1-1/8" $^{+1/16"}_{-0}$

GUIDE TUBE SPACING N/R

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION: DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	155 ipm	55 V	1-1/2 in.	390-400 A	4 sec.	13 sec.	4 cpm	1 3/4 in.	Used one water cooler
RUNNING	↓	↓	—	↓	↓	↓	↓	↓	

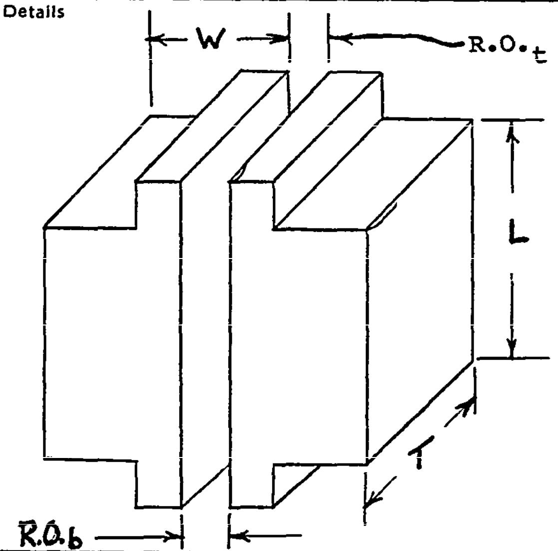
Technicians/SSN	Charge	Date	Joint No.
Byrd	1026M-9	6/6/84	M685-12

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting	Preheat (min) 125°F; method Torch; measured by Tempstick; PREHEAT SUMP AREA ONLY; Interpass N/A
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator		
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018	1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018	
BASE MAT'L	Dimensions: 12"L x 9"W x11"T; PO/Heat/Lot: ; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59; 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74; Storage Flux oven @ 250°F, Remained warm to touch	
COOLING SHOES	Size/Type: 24" Long/Copper; Flow: N/R; Max Temp: 125 °F	FINAL VISUAL: ___ Satisfactory X Visual Defects; Description ~~LOF on both sides,~~ full length	FINAL RT: ___ Satisfactory; ___ Unsatisfactory N/A; Procedure	

Joint Design & Details



$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}1/8" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING N/R

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	OSCILLATION CYCLE TIME	OSCILLATION FREQUENCY	OSCILLATION AMPLITUDE	
START	155 ipm	55 V	1-1/2 in.	390-400 A	4 sec.	13 sec.	4 cpm	1 3/4 in.	Used one water cooler
RUNNING	155 ipm	53 V	—	390-400 A	↓	↓	↓	↓	

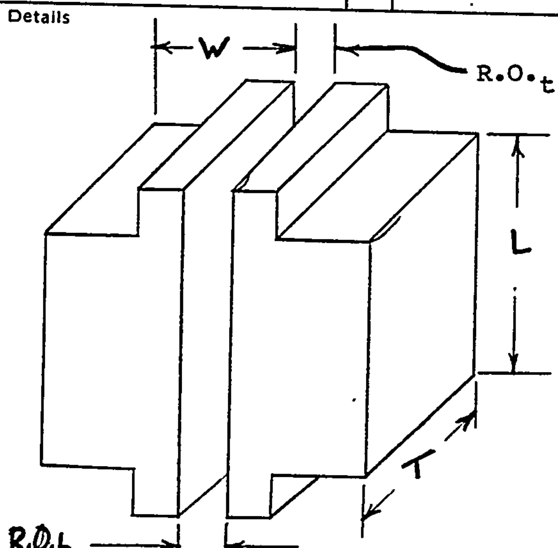
Technicians/SSN	Charge	Date	Joint No.
Byrd	1026M-9	6/3/84	M685-13

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting	Preheat (min) 125°F; method Torch; measured by Tempstick
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator		PREHEAT SUMP AREA ONLY; Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018		1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 18"L x 12"W x 13"T; PO/Heat/Lot: ; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59; 5/8" Inside Diameter		FLUX: Brand/Type Linde 124/F74; Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type 24" Long/Copper; Flow 1.7 GPM; Max Temp 140 °F	FINAL VISUAL: ___ Satisfactory; X Visual Defects; Description LOF on Side 1, 6" Long, 3/16" deep repaired		FINAL RT: ___ Satisfactory; X Unsatisfactory; Procedure 0900-003-9000 CL 1

Joint Design & Details



$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}1/8" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING 2 1/2"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION: DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	155 ipm	55 V	1-1/2 in.	390-400 A	4 sec.	13 sec.	4 cpm	1 3/4 in.	Joint was restarted after trouble with wire feeder losing power Used one water cooler
RUNNING	155 ipm	50 V	—	385-390 A	↓	↓	↓	↓	
	155 ipm	45 V	—	360-385 A	↓	↓	↓	↓	

Technicians/SSN	Charge	Date	Joint No.
Byrd	1026M-9	7/19/84	M685-14

ELECTROSLAG DATA SHEET

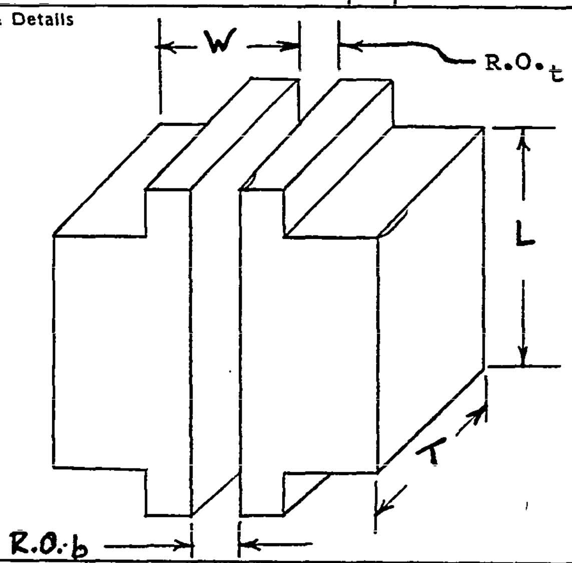
Newport News Shipbuilding
A Tenneco Company

PROCESS	3 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting	Preheat (min) 125°F; method Torch; measured by Tempstick; PREHEAT SUMP AREA ONLY; Interpass N/A
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator		

FILLER MAT'L	Size/Type	3/32" Dia./Cored Wire	5/8" Dia. Guide Tubes	1/4" Dia. Round Bar
	Brand	Hobart PS-588	Hobart Type No. 58	Commercial
	Specification	EWT2 (AWS 5.25-78)	ASTM A108 Gr. 1018	ASTM A108 Gr. 1018

BASE MAT'L	Dimensions: 26"Lx18"Wx10-3/4"T; PO/Heat/Lot: ; Specification: MIL-S-15083 Gr. B	INSULATOR	Hobart Type No. 59; 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74; Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type 24" Long/Copper; Flow 1.7 GPM; Max Temp 135 °F	FINAL VISUAL	X Satisfactory ___ Visual Defects; Description: Good Appearance	FINAL RT: X Satisfactory; ___ Unsatisfactory; Procedure 0900-003-9000 CL 1

Joint Design & Details



$R.O._t = 1\text{-}1/4" \ {}^{+\,1/16"}_{-\,0}$

$R.O._b = 1\text{-}1/8" \ {}^{+\,1/16"}_{-\,0}$

GUIDE TUBE SPACING N/R

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	135 ipm	49 V	1-1/2 in.	300-350 A	4 sec.	13 sec.	4 cpm	1 3/4 in.	Used one water cooler
RUNNING	135 ipm	49 V	—	300-350 A	↓	↓	↓	↓	

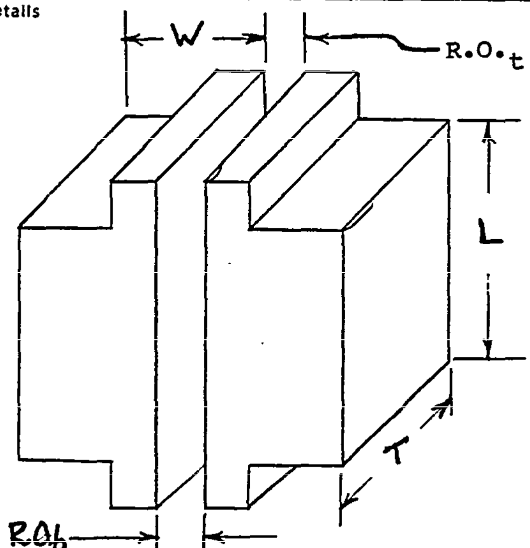
Technicians/SSN	Charge	Date	Joint No.
Byrd	1026M-9	9/25/94	M685-15

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate / X casting	Preheat (min) 125°F; method Torch; measured by Tempstick; PREHEAT SUMP AREA ONLY; Interpass N/A
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator		
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018	1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018	
BASE MAT'L	Dimensions: 30"Lx8"Wx12 3/4"T; PO/Heat/Lot: ; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59; 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74; Storage Flux oven @ 250°F, Remained warm to touch	
COOLING SHOES	Size/Type 24" Long/Copper; Flow 1.7 GPM; Max Temp 100/125 °F	FINAL VISUAL: X Satisfactory; Visual Defects; Description Completed area of weld had good appearance	FINAL RT: X Satisfactory; Unsatisfactory; Procedure 0900-003-9000 CL 1	

Joint Design & Details



$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}1/8" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING N/R

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION: DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	135 ipm	49 V	1-1/2 in.	390 A	4 sec.	13 sec.	4 cpm	1 3/4 in.	
RUNNING	↓	↓	—	↓	↓	↓	↓	↓	Weld was stopped 1" from run-off due to power supply failure

Technicians/SSN	Charge	Date	Joint No.
Byrd	1026M-9	10/12/84	M685-16

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting
Preheat (min)	125°F	method	Torch Tempstick
measured by			
PREHEAT SUMP AREA ONLY		Interpass	N/A

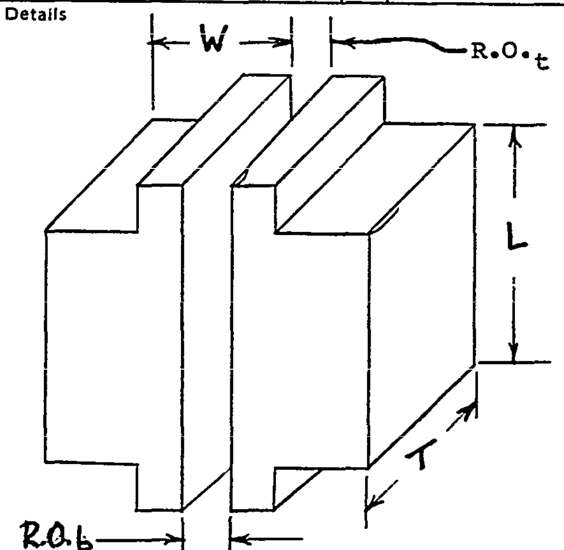
EQUIPMENT		CONTROLS
Power Supply	Hobart RC-1000	Hobart Multi-Torch Control Box
Polarity	DCEP	Hobart Multi-Wire Oscillator
Wire Feeder	Hobart	

FILLER MAT'L			
Size/Type	3/32" Dia./Cored Wire	5/8" Dia. Guide Tubes	1/4" Dia. Round Bar
Brand	Hobart PS-588	Hobart Type No. 58	Commercial
Specification	EWT2 (AWS 5.25-78)	ASTM A108 Gr. 1018	ASTM A108 Gr. 1018

BASE MAT'L		INSULATOR	FLUX
Dimensions	27"L x 12"w x 12"T	Hobart Type No. 59	Brand/Type: Linde 124/F74
PO/Heat/Lot		5/8" Inside Diameter	Storage: Flux oven @ 250°F, Remained warm to touch
Specification	MIL-S-15083 Gr. B		

COOLING SHOES		FINAL VISUAL	FINAL RT
Size/Type	24" Long/Copper	___ Satisfactory; X Visual Defects	___ Satisfactory; ___ Unsatisfactory: N/A
Flow	1.7 GPM	Description: ~~LOF on~~ Both sides approx. 6" Long	Procedure
Max Temp	130 °F		

Joint Design & Details



$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}1/8" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING: N/R

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION: DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	135 ipm	50 V	1-1/2 in.	395-400 A	4 sec.	13 sec.	4 cpm	1 3/4 in.	Spacer bars were not above top of the run-off block
RUNNING	135 ipm	49 V	—	390-400 A	↓	↓	↓	↓	Bars melted prior to reaching run-off. #1 then arced to the sidewall and stopped working. Joint stopped 1" from top.

Technicians/SSN	Charge	Date	Joint No.
Byrd/Meckley	1026M-9	10/30/84	M685-17

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS: 4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING

POSITION: VERTICAL UP

___ plate
X casting

Preheat (min): 125°
method: Torch
measured by: Tempstick

PREHEAT SUMP AREA ONLY
Interpass: N/A

EQUIPMENT

Power Supply	Hobart RC-1000	CONTROLS:	Hobart Multi-Torch Control Box
Polarity	DCEP		Hobart Multi-Wire Oscillator
Wire Feeder	Hobart		

FILLER MAT'L

Size/Type	3/32" Dia./Cored Wire	5/8" Dia. Guide Tubes	1/4" Dia. Round Bar
Brand	Hobart PS-588	Hobart Type No. 58	Commercial
Specification	EWT2 (AWS 5.25-78)	ASTM A108 Gr. 1018	ASTM A108 Gr. 1018

BASE MAT'L

Dimensions	30"Lx12"Wx10-3/4"T
PO/Heat/Lot	
Specification	MIL-S-15083 Gr. B

INSULATOR: Hobart Type No. 59, 5/8" Inside Diameter

FLUX: Brand/Type: Linde 124/F74
Storage: Flux oven @ 250°F, Remained warm to touch

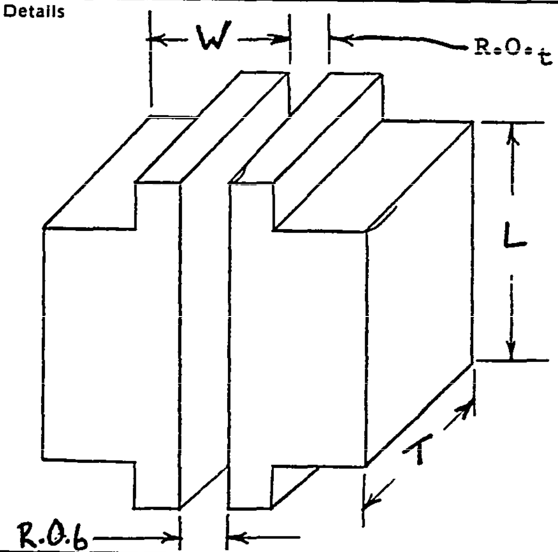
COOLING SHOES

Size/Type	24" Long/Copper
Flow	1.7 GPM
Max Temp	125/125 °F

FINAL VISUAL: X Satisfactory ___ Visual Defects
Description: Good Appearance

FINAL RT: X Satisfactory ___ Unsatisfactory
Procedure: 0900-003-9000 CL 1

Joint Design & Details



$R.O._t = 1\text{-}1/4" \; {}^{+1/16"}_{-0}$

$R.O._b = 1\text{-}1/8" \; {}^{+1/16"}_{-0}$

GUIDE TUBE SPACING 2-25/32"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	OSCILLATION CYCLE TIME	OSCILLATION FREQUENCY	OSCILLATION AMPLITUDE	
START	135 ipm	55 V	1-1/2 in.	390-400 A	4 sec.	13 sec.	4 cpm	1 7/8 in.	#1 Wire Stopped for 2 mins. at start
RUNNING	↓	↓	—	↓	↓	↓	↓	↓	Transverse shinkage from 6" punchmarks Top -0" Middle -1/4" Bottom -3/16"

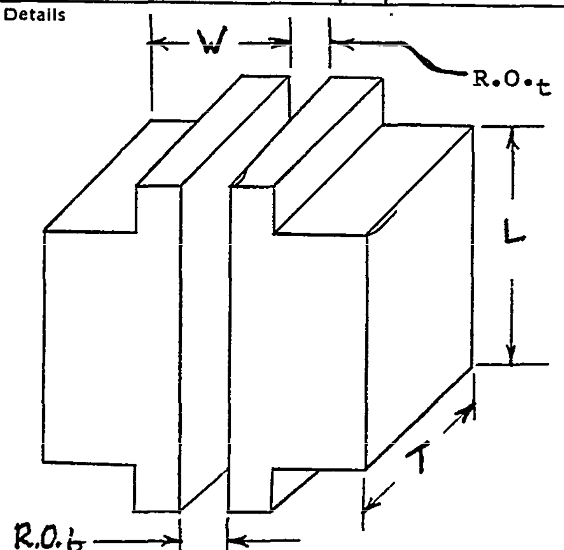
Technicians/SSN	Charge	Date	Joint No.
Byrd/Meckley	1026M-9	1/22/85	M685-18

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate X casting	Preheat (min) 125°F method Torch measured by Tempstick PREHEAT SUMP AREA ONLY Interpass N/A
EQUIPMENT	Power Supply: Hobart RC-1000 Polarity: DCEP Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box Hobart Multi-Wire Oscillator		
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire Brand: Hobart PS-588 Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes Hobart Type No. 58 ASTM A108 Gr. 1018	1/4" Dia. Round Bar Commercial ASTM A108 Gr. 1018	
BASE MAT'L	Dimensions: 12"Lx12"Wx12 3/4"T PO/Heat/Lot: Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74 Storage Flux oven @ 250°F, Remained warm to touch	
COOLING SHOES	Size/Type: 24" Long/Copper Flow: 1.7 GPM Max Temp: 125 °F	FINAL VISUAL: X Satisfactory ___ Visual Defects Description: Good Appearance	FINAL RT: ___ Satisfactory X Unsatisfactory Procedure 0900-003-9000 CL 1	

Joint Design & Details



R.O.$_t$ = 1-1/4" $^{+1/16"}_{-0}$

R.O.$_b$ = 1-1/8" $^{+1/16"}_{-0}$

GUIDE TUBE SPACING 2 13/16"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	OSCILLATION CYCLE TIME	OSCILLATION FREQUENCY	OSCILLATION AMPLITUDE	
START	130 ipm	53 V	1-1/2 in.	350-400 A	4 sec.	13 sec.	4 cpm	1 3/4 in.	Used on water cooler. Joint was restarted after #2 stopped during initial firing. #1 & #4 stopped running for 2-3 Mins. during 2nd firing.
RUNNING	155 ipm	55 V	—	390-400 A	↓	↓	↓	↓	RT showed severe ℄ cracking in the weld Final slag depth = 1" 6 rows of RD Bar

Technicians/SSN	Charge	Date	Joint No.
Byrd/Meckley	1026M-9	2/14/85	M685-19

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	X plate / ___ casting
EQUIPMENT	Power Supply: Hobart RC-1000 Polarity: DCEP Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box Hobart Multi-Wire Oscillator	

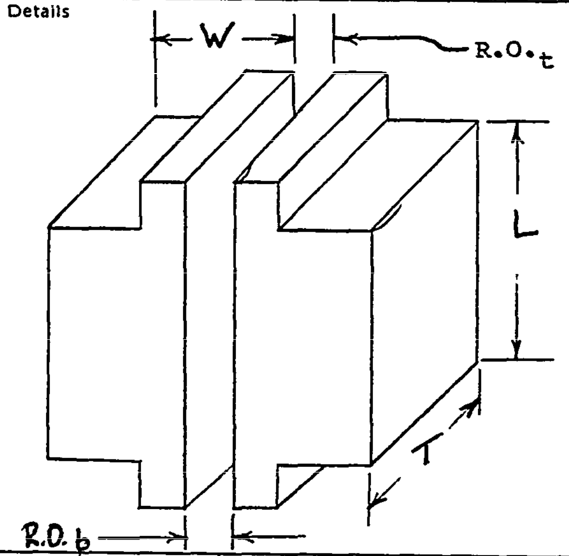
Preheat (min): 125°F
method: Torch
measured by: Tempstick
PREHEAT SUMP AREA ONLY
Interpass: N/A

FILLER MAT'L	Wire	Guide Tubes	Round Bar
Size/Type	3/32" Dia./Cored Wire	5/8" Dia. Guide Tubes	1/4" Dia. Round Bar
Brand	Hobart PS-588	Hobart Type No. 58	Commercial
Specification	EWT2 (AWS 5.25-78)	ASTM A108 Gr. 1018	ASTM A108 Gr. 1018

BASE MAT'L		INSULATOR	FLUX
Dimensions: 6"L x 4"W x 13"T		Hobart Type No. 59 5/8" Inside Diameter	Brand/Type: Linde 124/F74 Storage: Flux oven @ 250°F, Remained warm to touch
PO/Heat/Lot:			
Specification: MIL-S-15083 Gr. B			

COOLING SHOES	FINAL VISUAL	FINAL RT
Size/Type: 24" Long/Copper Flow: N/R Max Temp: N/R °F	X Satisfactory ___ Visual Defects Description: Good Appearance	___ Satisfactory ___ Unsatisfactory N/A Procedure

Joint Design & Details



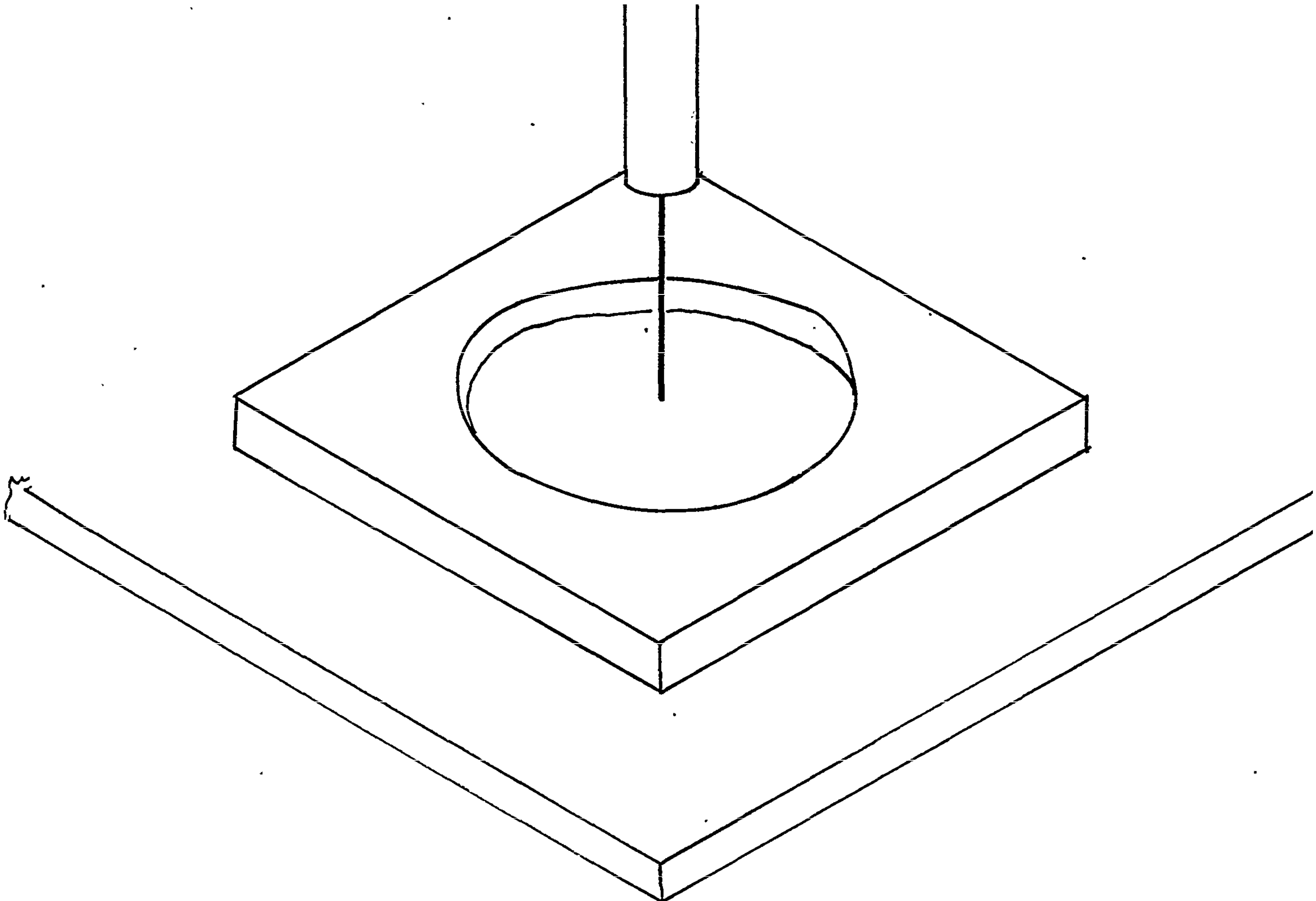
$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}1/8" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING 2-7/8"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	OSCILLATION CYCLE TIME	OSCILLATION FREQUENCY	OSCILLATION AMPLITUDE	
START	130 ipm	55 V	1-1/2 in.	350-380 A	4 sec.	13 sec.	4 cpm	1 3/4 in.	Experienced starting problems with #3 wire, resolved after 2 minutes. Heavy spatter on side walls
RUNNING	155 ipm	55 V	—	380-400 A	↓	↓	↓	↓	3 rows of RD Bar Final Slag depth = 1"

Technicians/SSN	Charge	Date	Joint No.
Byrd/Meckley	1026M-9	2/19/85	M685-19A



Parameters	Results
1. 130 ipm, 55 volts, no flux added, 1 1/2" ESO	Heavy spatter, mostly large globules
2. 110-160 ipm 45 volts	Lower voltage reduced spatter. Lower wire feeds slightly reduced spatt
3. 130 ipm, 45 volts, flux added after steel wool melts.	Addition of flux reduced spatter, and did not extinguish arc.
4. 130 ipm, 55 volts, flux added after steel wool melts.	More spatter than #3, arc was extinguis by addition of flux
5. 130 ipm, 55 volts, flux added prior to start	Better start than #4, still a lot of spatter.
6. 130 ipm, 35 volts, flux added after steel wool melts.	Good start, increasing volts to 55 grea increased spatter, reduced volts back t 35 which reduced spatter.
7. 130 ipm, 35 volts, flux added prior to start	Good start. Increasing wire speed 30 i did not significantly increase spatter. Increasing volts to 55 did increase spa

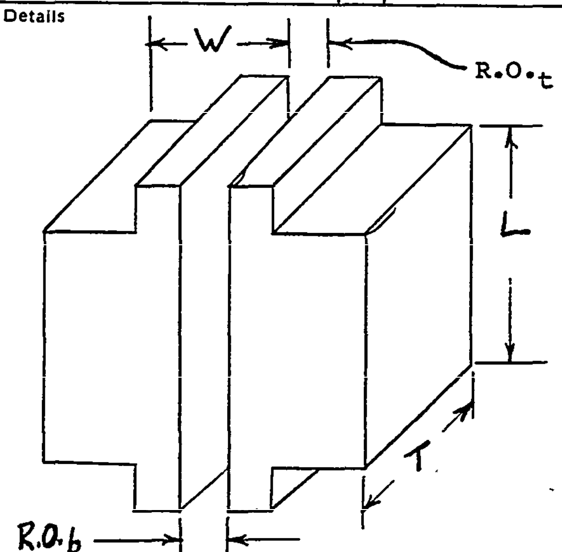
All Welding Using a single electrode 1 1/2" E.S.O. DCRP.

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	X plate ___ casting	Preheat (min) N/A method Torch measured by Tempstick
EQUIPMENT	Power Supply: Hobart RC-1000 Polarity: DCEP Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box Hobart Multi-Wire Oscillator		PREHEAT SUMP AREA ONLY Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire Brand: Hobart PS-588 Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes Hobart Type No. 58 ASTM A108 Gr. 1018	1/4" Dia. Round Bar Commercial ASTM A108 Gr. 1018	
BASE MAT'L	Dimensions: 6"L x 4"W x 13"T PO/Heat/Lot: Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74 Storage Flux oven @ 250°F, Remained warm to touch	
COOLING SHOES	Size/Type: 24" Long/Copper Flow: N/R Max Temp: 75 °F	FINAL VISUAL: X Satisfactory ___ Visual Defects Description	FINAL RT: ___ Satisfactory ___ Unsatisfactory N/A Procedure	

Joint Design & Details



$R.O._t = 1\text{-}1/4" \ {}^{+1/16"}_{-0}$

$R.O._b = 1\text{-}1/8" \ {}^{+1/16"}_{-0}$

GUIDE TUBE SPACING 2 7/8"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	OSCILLATION CYCLE TIME	OSCILLATION FREQUENCY	OSCILLATION AMPLITUDE	
START	130 ipm	35 V	1-1/2 in.	N/R A	3 sec.	12 sec.	5 cpm	1 3/4 in.	Flux placed around #2 before starting. Good Start Macro shows no defects
RUNNING	155 ipm	55 V	—	N/R	↓	↓	↓	↓	Final slag depth = 1 1/8" 3 Rows of RD Bar

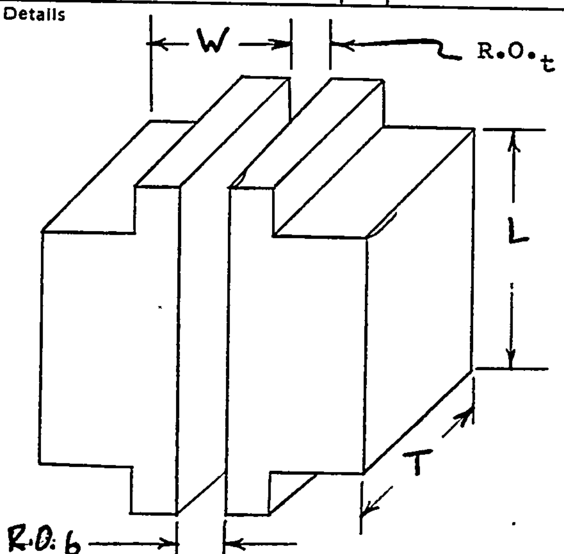
Technicians/SSN	Charge	Date	Joint No.
Meckley/Byrd	1026M-9	2/21/85	M685-19B-1

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	2 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION	VERTICAL UP
	X plate ___ casting		Preheat (min) 125°F method Torch measured by Tempstick PREHEAT SUMP AREA ONLY Interpass N/A
EQUIP-MENT	Power Supply: Hobart RC-1000 Polarity: DCEP Wire Feeder: Hobart	CONTROLS:	Hobart Multi-Torch Control Box Hobart Multi-Wire Oscillator
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire Brand: Hobart PS-588 Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes Hobart Type No. 58 ASTM A108 Gr. 1018	1/4" Dia. Round Bar Commercial ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 10"L x 4"W x 13"T PO/Heat/Lot: Specification: MIL-S-15083 Gr. B	INSU-LATOR: Hobart Type No. 59 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74 Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type: 24" Long/Copper Flow: 1.7 GPM Max Temp: 100 °F	FINAL VISUAL: X Satisfactory ___ Visual Defects Description	FINAL RT: ___ Satisfactory ___ Unsatisfactory N/A Procedure

Joint Design & Details



R.O.$_t$ = 1-1/4" $^{+1/16"}_{-0}$

R.O.$_b$ = 1-1/8" $^{+1/16"}_{-0}$

GUIDE TUBE SPACING 2 7/8"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	OSCILLATION CYCLE TIME	OSCILLATION FREQUENCY	OSCILLATION AMPLITUDE	
START	130 ipm	35 V	1-1/2 in.	350-450 A	3 sec.	12 sec.	5 cpm	1 3/4 in.	Steel wool under each wire, covered with Flux. Fired all four at the same time. #3 experienced a 5 min. delay.
RUNNING	155 ipm	55 V	—	390-400 A					Final slag depth 1" 4 rows of RD bar

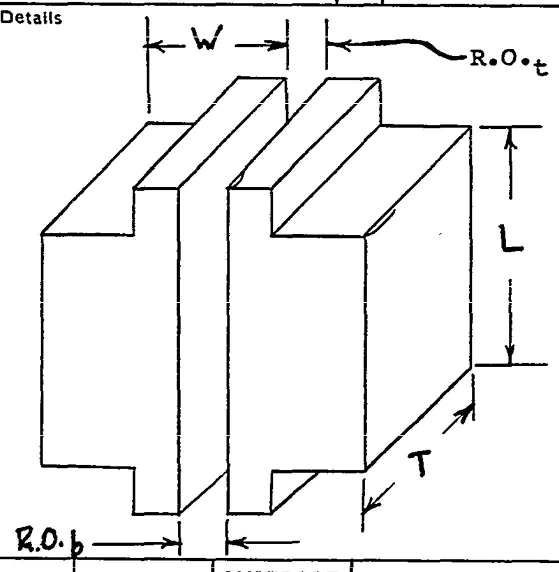
Technicians/SSN	Charge	Date	Joint No.
Byrd/Meckley	1026M-9	2/22/85	M685-19C

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	3 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	X plate / ___ casting	Preheat (min) N/A; method Torch; measured by Tempstick
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box, Hobart Multi-Wire Oscillator		PREHEAT SUMP AREA ONLY; Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018		1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 5"L x 4"W x 12"T; PO/Heat/Lot: ; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59, 5/8" Inside Diameter		FLUX: Brand/Type Linde 124/F74; Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type: 24" Long/Copper; Flow: 1.7 GPM; Max Temp: 75 °F	FINAL VISUAL: X Satisfactory; Visual Defects; Description: Macro - MT Clear		FINAL RT: ___ Satisfactory; ___ Unsatisfactory N/A; Procedure

Joint Design & Details



$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING 3-7/8" & 4-3/4'

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION: DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	130 ipm	55 V	1-1/2 in.	350-370 A	3 sec.	12 sec.	5 cpm	1 15/16 in.	#2 Experienced a 2 min. delay
RUNNING	170-190 ipm	55 V	—	390-420 A	↓	↓	↓	↓	Final Slag Depth 1 1/4" 3 rows of RD. Bar

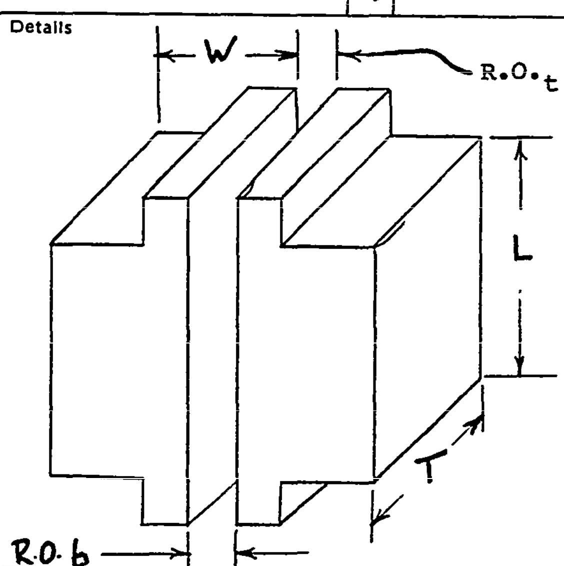
Technicians/SSN	Charge	Date	Joint No.
Meckley/Byrd	1026M-9	2/28/85	M685-19D

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	plate; X casting	Preheat (min) 125°F; method Torch; measured by Tempstick
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator		PREHEAT SUMP AREA ONLY; Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018	1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018	
BASE MAT'L	Dimensions: 18"Lx12"Wx15-3/4"T; PO/Heat/Lot: ; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59; 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74; Storage Flux oven @ 250°F, Remained warm to touch	
COOLING SHOES	Size/Type 24" Long/Copper; Flow 1.7 GPM; Max Temp 125 °F	FINAL VISUAL: Satisfactory; X Visual Defects; Description <1/8" LOF in several small locations	FINAL RT: X Satisfactory; Unsatisfactory; Procedure 0900-003-9000 CL 1	

Joint Design & Details



$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}1/8" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING 3-13/16"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION: DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	130 ipm	35 V	1-1/2 in.	300-350 A	3 sec.	12 sec.	5 cpm	1 15/16 in.	#4 Experienced a 5 min. delay. Added flux as each wire w[as] started. 4 Rows of RD Bar
RUNNING	135 ipm	55 v	—	350-390 A	↓	↓	↓	↓	Final Slag Depth - 1 1/4" Transverse shrinkage from 8" punchmarks: Top -1/8" Middle -1/8" Bottom -1/8"

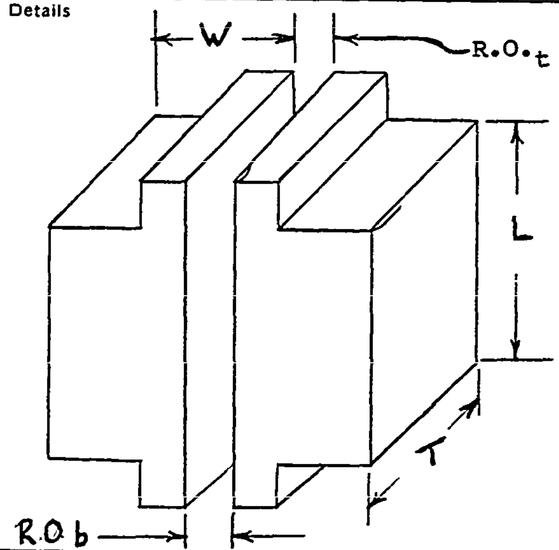
Technicians/SSN	Charge	Date	Joint No.
Meckley/Byrd	1026M-9	2/27/85	M685-20

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting	Preheat (min) 125°F; method Torch; measured by Tempstick
EQUIP-MENT	Power Supply: Hobart RC-1000 Polarity: DCEP Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box Hobart Multi-Wire Oscillator		PREHEAT SUMP AREA ONLY Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire Brand: Hobart PS-588 Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes Hobart Type No. 58 ASTM A108 Gr. 1018		1/4" Dia. Round Bar Commercial ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 18"Lx12"Wx15 3/4"T PO/Heat/Lot: Specification: MIL-S-15083 Gr. B	INSU-LATOR: Hobart Type No. 59 5/8" Inside Diameter		FLUX: Brand/Type Linde 124/F74 Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type 24" Long/Copper Flow N/R Max Temp 135/100 °F	FINAL VISUAL: ___ Satisfactory X Visual Defects Description LOF ~~< 1/8"~~ on Both sides-full length		FINAL RT: X Satisfactory ___ Unsatisfactory Procedure 0900-003-9000 CL 1

Joint Design & Details



$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}1/8" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING 3-15/16" - 4"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	OSCILLATION CYCLE TIME	OSCILLATION FREQUENCY	OSCILLATION AMPLITUDE	
START	130 ipm	45 V	1-1/2 in.	350-390 A	3 sec.	12 sec.	5 cpm	1 3/4 in.	Good Start - flux added as each wire was fired. Approx. 1-1 1/2 mins. between wires starting. 3 Rows of RD Bar
RUNNING	165 ipm	55 V	—	380-400 A	↓	↓	↓	↓	Final slag depth - 1 1/4" Transverse shrinkage from 8" punchmarks: Top -1/8" Middle -1/8" Bottom -1/8"

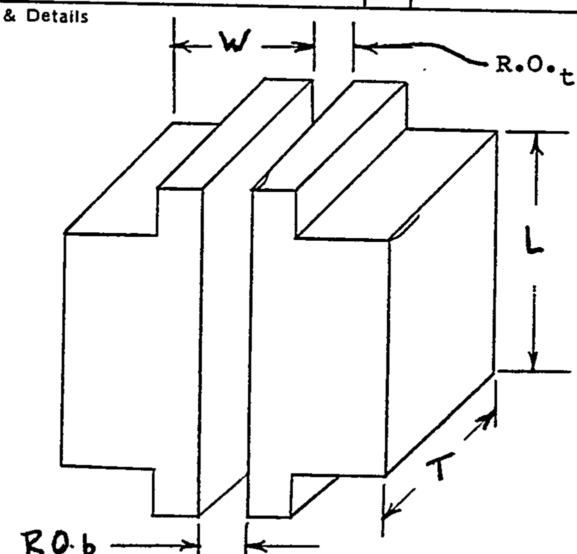
Technicians/SSN	Charge	Date	Joint No.
Byrd/Meckley	1026M-9	3/7/85	M685-21

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator	Preheat (min) 125°F; method Torch; measured by Tempstick; PREHEAT SUMP AREA ONLY; Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018	1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 18"Lx12"Wx15-3/4"T; PO/Heat/Lot: ; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59; 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74; Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type 24" Long/Copper; Flow 1.7 GPM; Max Temp 100/140 °F	FINAL VISUAL: ___ Satisfactory; Visual Defects; Description 1 1/2" LG LOF at Bottom of side 2	FINAL RT: X Satisfactory; ___ Unsatisfactory; Procedure 0900-003-9000 CL 1

Joint Design & Details



$R.O._t = 1\text{-}1/4" \; {}^{+1/16"}_{-0}$

$R.O._b = 1\text{-}1/8" \; {}^{+1/16"}_{-0}$

GUIDE TUBE SPACING 3-7/8"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	OSCILLATION CYCLE TIME	OSCILLATION FREQUENCY	OSCILLATION AMPLITUDE	
START	130 ipm	40 V	1-1/2 in.	350-370 A.	3 sec.	12 sec.	5 cpm	2 in.	No flux added until wires were fired. Good start. 4 Rows of RD Bar
RUNNING	165 ipm	55 V	—	370-400 A	↓	↓	↓	↓	Final Slag Depth = 1 1/4' Transverse shrinkage from 8" punchmarks Top -1/8" Middle -1/8" Bottom -1/8"

Technicians/SSN	Charge	Date	Joint No.
Byrd/Meckley	1026M-9	3/14/85	M685-22

ELECTROSLAG DATA SHEET

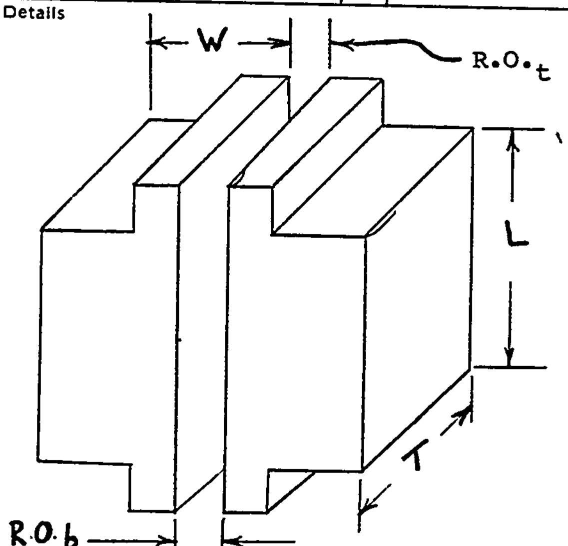
Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate X casting
EQUIPMENT	Power Supply: Hobart RC-1000 Polarity: DCEP Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box Hobart Multi-Wire Oscillator	

Preheat (min) 125°F
method Torch
measured by Tempstick
PREHEAT SUMP AREA ONLY
Interpass N/A

FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire Brand: Hobart PS-588 Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes Hobart Type No. 58 ASTM A108 Gr. 1018	1/4" Dia. Round Bar Commercial ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 18"Lx12"Wx 18-3/4"T PO/Heat/Lot: Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74 Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type 24" Long/Copper Flow 1.7 GPM Max Temp 170 °F	FINAL VISUAL: ___ Satisfactory X Visual Defects Description LOF both sides 1"-4" Long < 1/8" Deep	FINAL RT: X Satisfactory ___ Unsatisfactory Procedure 0900-003-9000 CL 1

Joint Design & Details



$R.O._t = 1\text{-}1/4" \; {}^{+\,1/16"}_{-\,0}$

$R.O._b = 1\text{-}1/8" \; {}^{+\,1/16"}_{-\,0}$

GUIDE TUBE SPACING 4-11/16"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION: DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	130 ipm	45 V	1-1/2 in.	350-370 A	3 sec.	12 sec.	5 cpm	2-3/16 in.	Good Start
RUNNING	140 ipm	55 V	—	370-390 A	↓	↓	↓	↓	Final Slag Depth = 1-1/4" Transverse Shrinkage from 8" punchmarks: Top -1/8" Middle -1/8" Bottom -1/8"

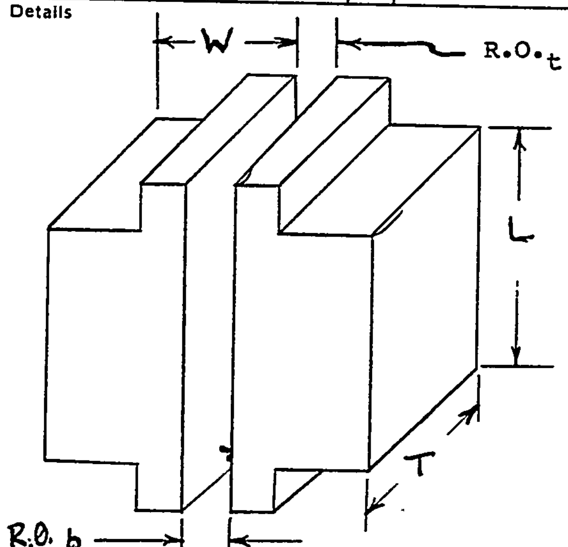
Technicians/SSN	Charge	Date	Joint No.
Meckley/Byrd	1026M-9	3/29/85	M685-22F

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate X casting
			Preheat (min) 125°F method Torch measured by Tempstick PREHEAT SUMP AREA ONLY Interpass N/A
EQUIPMENT	Power Supply: Hobart RC-1000 Polarity: DCEP Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box Hobart Multi-Wire Oscillator	
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire Brand: Hobart PS-588 Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes Hobart Type No. 58 ASTM A108 Gr. 1018	1/4" Dia. Round Bar Commercial ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 18"Lx12"Wx18 3/4"T PO/Heat/Lot Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59 5/8" Inside Diameter	FLUX: Brand/Type Linde 124/F74 Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type 24" Long/Copper Flow 1.7 GPM Max Temp 140/150 °F	FINAL VISUAL: ___ Satisfactory X Visual Defects Description ~~<1/8" Deep~~ LOF on both sides was repaired	FINAL RT: ___ Satisfactory ___ Unsatisfactory N/A Procedure

Joint Design & Details



$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}1/8" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING 4-11/16"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION: DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	130 ipm	45 V	1-1/2 in.	350-370 A	4 sec.	12 sec.	5 cpm	2 3/16 in.	Flux around #2 prior to start, then added as wires were fired. #1 & #3 stopped briefly during start. 5 rows of RD Bar
RUNNING	145 ipm	55 V		370-400 A	↓	↓	↓	↓	Parameters checked every 5 mins. Transverse shrinkage from 8" punchmarks: Top -5/32" Middle -5/32" Bottom -1/8"

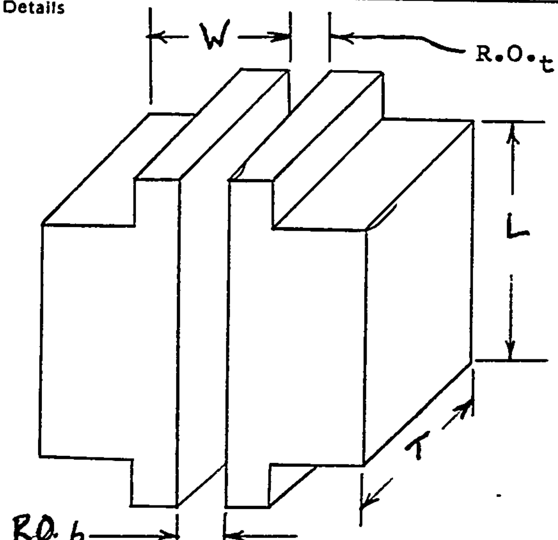
Technicians/SSN	Charge	Date	Joint No.
Meckley/Byrd	1026M-9	4/3/85	M685-23

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION	VERTICAL UP	___ plate; X casting	Preheat (min) 125°F; method Torch; measured by Tempstick; PREHEAT SUMP AREA ONLY; Interpass N/A
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS:	Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator		
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)		5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018		1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 18"Lx12"Wx18-3/4"T; PO/Heat/Lot: ; Specification: MIL-S-15083 Gr. B	INSULATOR	Hobart Type No. 59; 5/8" Inside Diameter	FLUX	Brand/Type: Linde 124/F74; Storage: Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type: 24" Long/Copper; Flow: 1.7 GPM; Max Temp: 125/145 °F	FINAL VISUAL	X Satisfactory; Visual Defects; Description: <1/16" deep undercut in 2 locations repaired	FINAL RT	___ Satisfactory; ___ Unsatisfactory; N/A; Procedure

Joint Design & Details



$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}1/8" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING 4-11/16"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	130 ipm	45 V	1-1/2 in.	350-370 A	4 sec.	12 sec.	5 cpm	2 3/16 in.	Flux around #2 prior to start, then added as wires were fired. 4 rows of RD Bar
RUNNING	155 ipm 140 ipm	55 V 55 V	(#1,4) (#2,3)	370-400 A	↓	↓	↓	↓	Final Slag depth = 7/8" Transverse shrinkage fro[m] 8" punchmarks: Top -1/8 Middle -1/8" Bottom -3/16

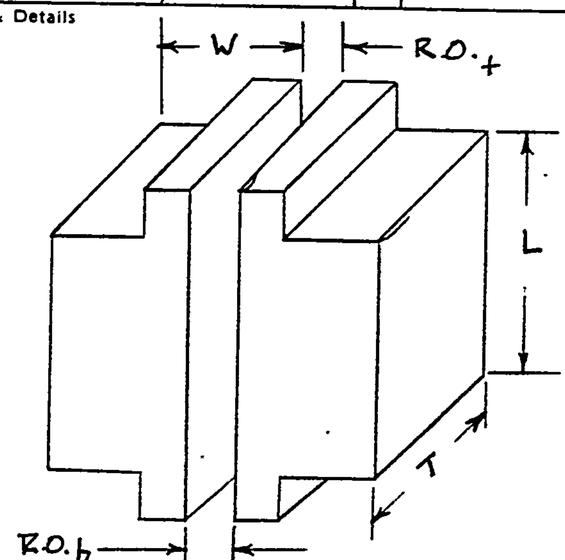
Technicians/SSN	Charge	Date	Joint No.
Byrd / Meckley	1026M-9	4/9/85	M685-24

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting	Preheat (min) 150°F; method Torch; measured by Tempstick
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator		PREHEAT SUMP AREA ONLY; Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018		1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 18"L x 12"W x 15-3/4"; PO/Heat/Lot; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59; 5/8" Inside Diameter		FLUX: Brand/Type Linde 124; Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type: 24" Long/Copper; Flow: .75 GPM; Max Temp: 155/155°F	FINAL VISUAL: X Satisfactory; ___ Visual Defects; Description		FINAL RT: ___ Satisfactory; ___ Unsatisfactory N/A; Procedure

Joint Design & Details



$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}1/8" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING 3 7/8"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	OSCILLATION CYCLE TIME	OSCILLATION FREQUENCY	OSCILLATION AMPLITUDE	
START	130 ipm	35 V	1-1/2 in.	250-300 A	3.5 sec.	11.5 sec.	5 cpm	1-5/8 in.	6 mins. to start. No flux added prior to arc initiation. Final slag Depth=1-1/8"
RUNNING	145 ipm	55 V	—	350-400 A	↓	↓	↓	↓	Transverse shrinkage from 8" punchmarks: Top -5/32"; Middle -3/16"; Bottom -1/8"

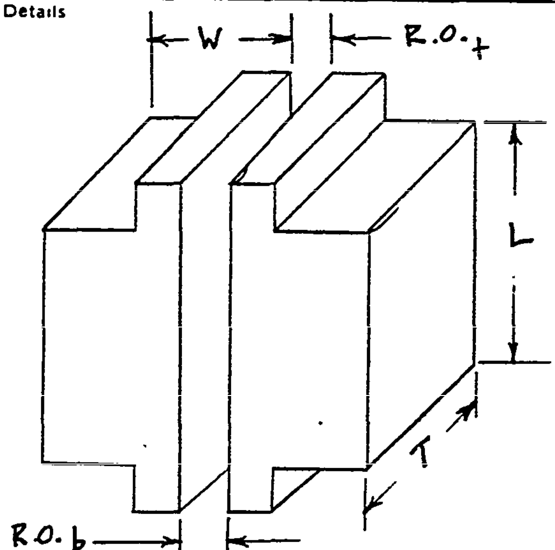
Technicians/SSN	Charge	Date	Joint No.
Byrd/Meckley	1026M-9	4/30/85	M685-25

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION	VERTICAL UP	___ plate X casting	Preheat (min) 150°F method Torch measured by Tempstick	
EQUIP-MENT	Power Supply Hobart RC-1000 Polarity DCEP Wire Feeder Hobart	CONTROLS: Hobart Multi-Torch Control Box Hobart Multi-Wire Oscillator			PREHEAT SUMP AREA ONLY interpass N/A	
FILLER MAT'L	Size/Type 3/32" Dia./Cored Wire Brand Hobart PS-588 Specification EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes Hobart Type No. 58 ASTM A108 Gr. 1018			1/4" Dia. Round Bar Commercial ASTM A108 Gr. 1018	
BASE MAT'L	Dimensions 24"L x 12"W x 22"T PO/Heat/Lot N/R Specification MIL-S-15083 Gr. B	INSU-LATOR	Hobart Type No. 59 5/8" Inside Diameter Remained warm to touch	FLUX	Brand/Type PF-203 & L-124 Storage Flux oven @ 250°F,	
COOLING SHOES	Size/Type 24" Long/Copper Flow N/R Max Temp 165°F	FINAL VISUAL	X Satisfactory ___ Visual Defects Description Good Appearance	FINAL RT	___ Satisfactory N/A Unsatisfactory Procedure	

Joint Design & Details



$R.O._t = 1\text{-}1/2" \;{}^{+1/16}_{-0}"$

$R.O._b = 1\text{-}3/8" \;{}^{+1/16}_{-0}$

GUIDE TUBE SPACING 5"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	155 ipm	45 V	1-1/2 in.	350-400 A	4 sec.	12 sec.	5 cpm	N/R	5 1/2 mins. to start
RUNNING	175 V	55	—	400-450 A	↓	↓	↓	↓	Deposition rate=72#/hr.
	195 ipm	55 V	—	450-500 A					

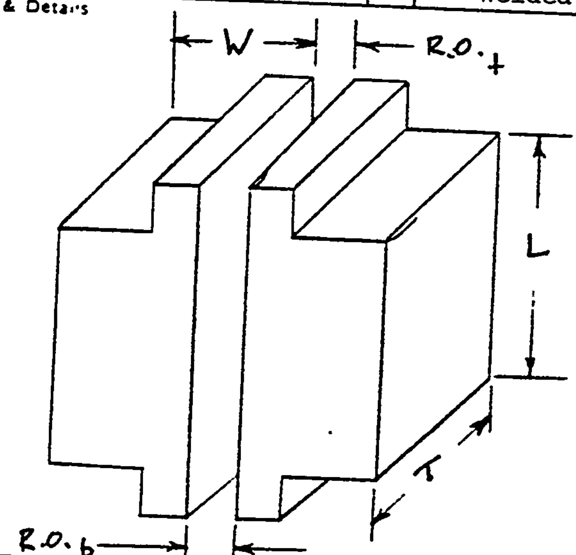
Technicians/SSN Byrd/Meckley | Charge 1026M-9 | Date 6/17/85 | Joint M685-28

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION	VERTICAL UP	___ plate X casting	Preheat (min) 300°F method Torch measured by Tempstick
EQUIP-MENT	Power Supply: Hobart RC-1000 Polarity: DCEP Wire Feeder: Hobart	CONTROLS:	Hobart Multi-Torch Control Box Hobart Multi-Wire Oscillator		PREHEAT SUMP AREA ONLY Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire Brand: Hobart PS-588 Specification: EWT2 (AWS 5.25-78)		5/8" Dia. Guide Tubes Hobart Type No. 58 ASTM A108 Gr. 1018		1/4" Dia. Round Bar Commercial ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 18"L x 12"W x 21-3/4" PO/Heat/Lot: Specification: MIL-S-15083 Gr. B	INSU-LATOR	Hobart Type No. 59 5/8" Inside Diameter	FLUX	Brand/Type PF-203 & L-124 Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type: 24" Long/Copper Flow: N/R Max Temp: 150°F	FINAL VISUAL	X Satisfactory ___ Visual Defects Description Weld not complete Welded area had no defects	FINAL RT	___ Satisfactory ___ Unsatisfactory N/A Procedure

Joint Design & Details



$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16 \\ -0\end{smallmatrix}"$

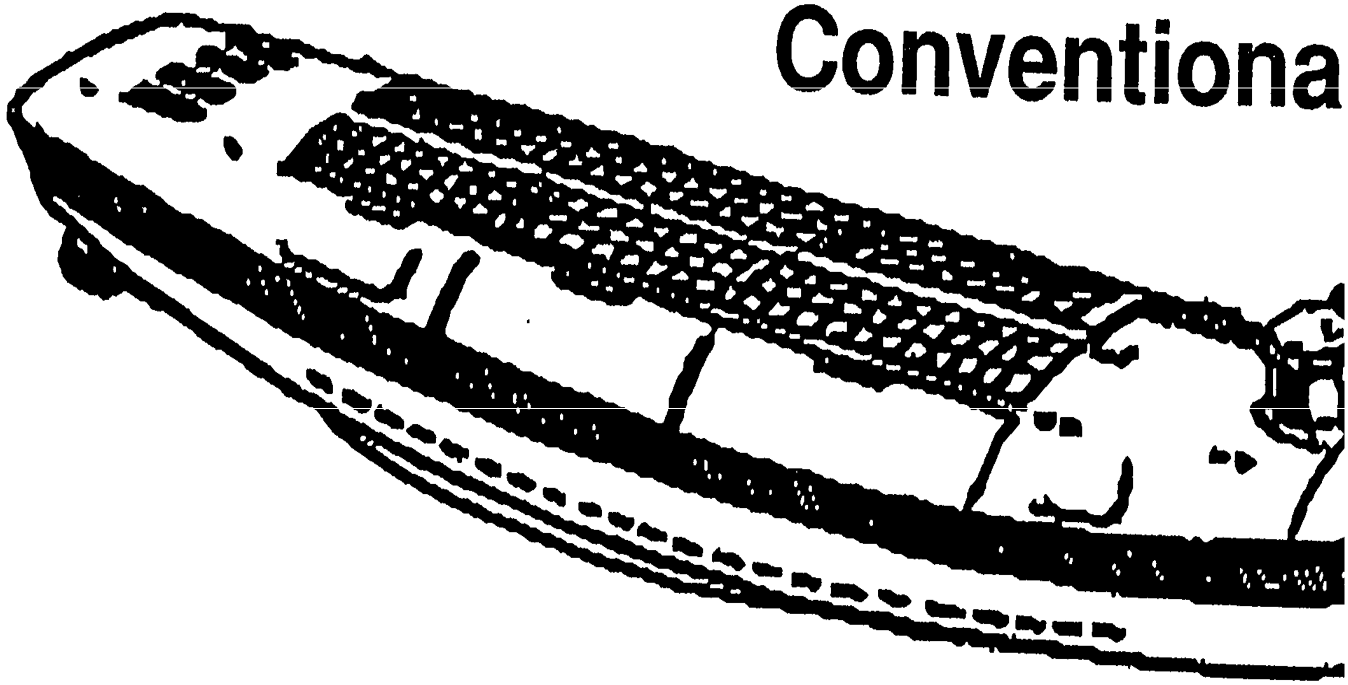
$R.O._b = 1\text{-}1/8" \begin{smallmatrix}+1/16 \\ -0\end{smallmatrix}"$

GUIDE TUBE SPACING 5"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION: DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	150 ipm	45 V	1-1/2 in.	350-400 A	4 sec	12 sec.	5 cpm	N/R	7 1/2 mins. to start
RUNNING	165 ipm	55 V	—	400-450 A	↓	↓	↓	↓	Joint stopped after 77 minutes when #4 arced against the sidewall. Shrinkage after welding 14" = 3/16"

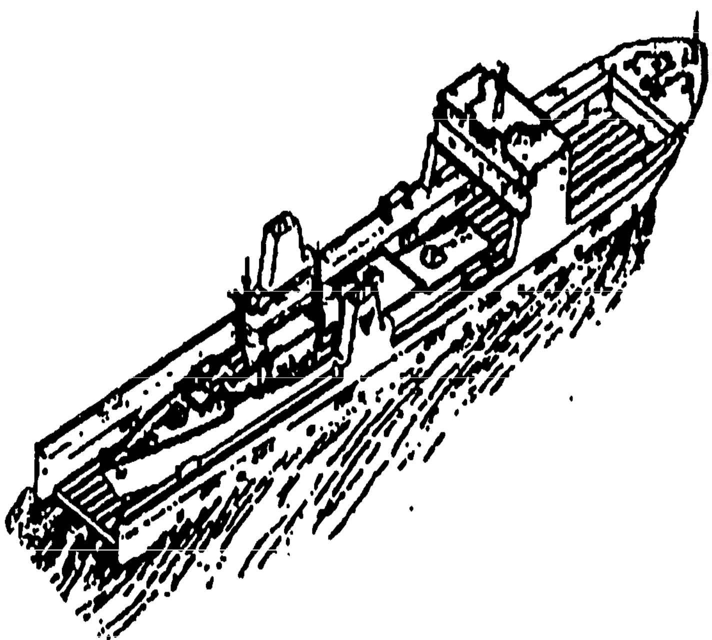
Technicians/SSN	Charge	Date	Joint No.
Byrd/Meckley	1026M-9	6/12/85	M685-27

Conventiona

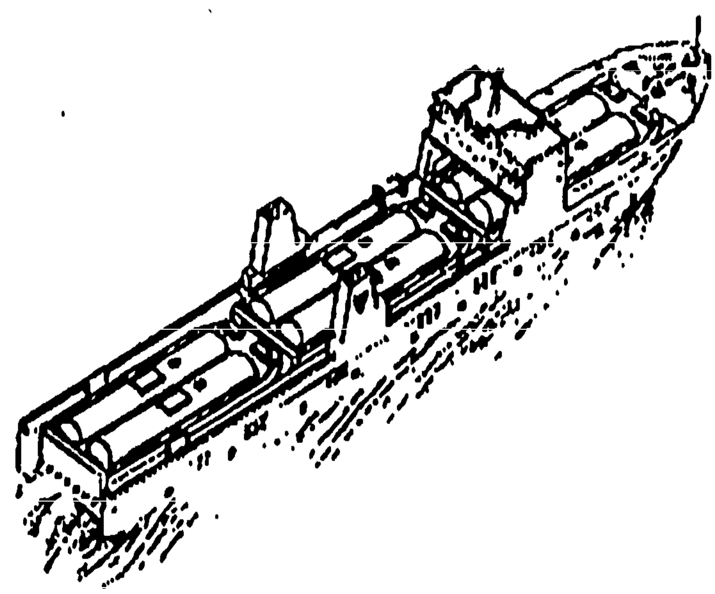


- Extention of current surface combatant, designed to make massive strike attacks and fend off massive attacks.
- "Large" weapon capability.
- Multi-warfare complete fighting units.
- Centralized Force command.
- Highly cooperativ systems to enh capability.
- Would stress mol endurance to c limited overseas

Mother Ship Force



- Force consists of large te
  ships, each transportin
  smaller combatants.
- This smaller surface com
  would be a high perforn
  craft, smaller than typi
  today (4,000 tons or le
  with emphasis on spee
  offensive capability.

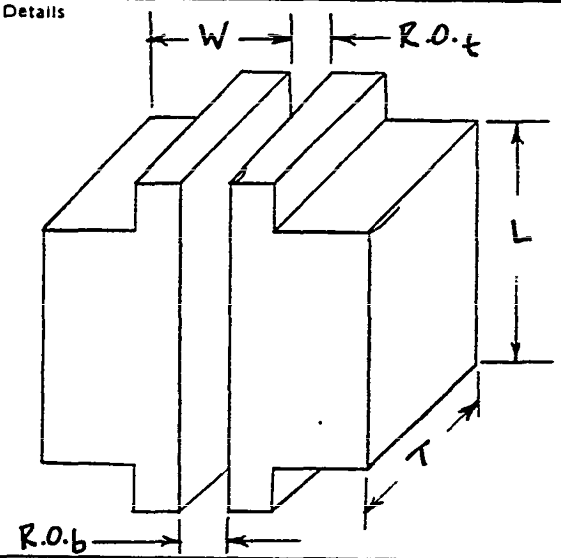


ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting
			Preheat (min): 150°F; method: Torch; measured by: Tempstick
EQUIP-MENT	Power Supply: Hobart RC-1000 Polarity: DCEP Wire Feeder: Hobart	CONTROLS: Hobart multi-torch control box Hobart multi-wire oscillator	--- PREHEAT SUMP AREA ONLY Interpass: N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire Brand: Hobart PS-588 Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide tubes Hobart Type No. 58 ASTM A108 Gr. 1018	1/4" Dia. round bar Commercial ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 24"L x 18"W x 18-3/8" PO/Heat/Lot: N/R Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59 5/8" Inside Diameter	FLUX: Brand/Type: Linde 124 Storage: Flux oven @250°F Remained warm to touch
COOLING SHOES	Size/Type: 24" Long/Copper Flow: .75 GPM Max Temp: N/R	FINAL VISUAL: ___ Satisfactory ___ Visual Defects Description: Weld not complete also LOF	FINAL RT: ___ Satisfactory ___ Unsatisfactory N/A Procedure

Joint Design & Details



$R.O._t = 1\text{-}1/4" \; {}^{+\,1/16"}_{-\,0}$

$R.O._b = 1\text{-}1/8" \; {}^{+\,1/16}_{-\,0}$

GUIDE TUBE SPACING 4 11/16"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	155 ipm	40 V	1-1/2 in.	250-300 A	3.5 sec.	11.5 sec.	5 cpm	2-5/16 in.	10 mins. to start. No flux added prior to arc initiation. Heavy spatter buildup at start.
RUNNING		55 V	—	350-400 A					Joint stopped after 50 mins. when #2 arced against the sidewall.

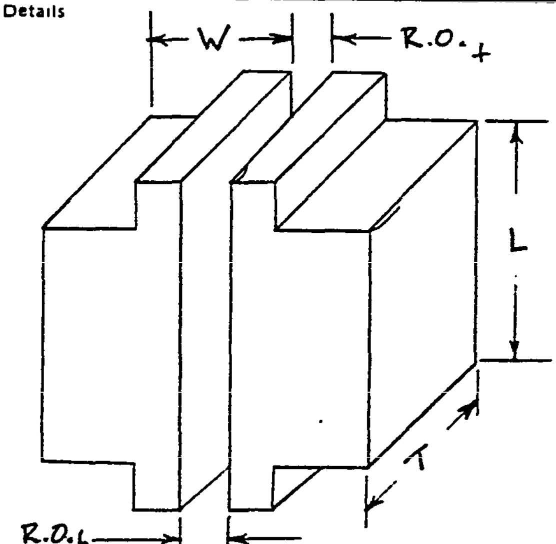
Technicians'SSN: Byrd/Meckley	Charge: 1026M-9	Date: 5/2/85	Joint No: M685-26

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting	Preheat (min) 150°F; method Torch; measured by Tempstick; PREHEAT SUMP AREA ONLY; Interpass N/A
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator		
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018	1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018	
BASE MAT'L	Dimensions: 24"L x 12"W x 24"T; PO/Heat/Lot: N/R; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59; 5/8" Inside Diameter; Remained warm to touch	FLUX: Brand/Type Linde 124 & PF-20; Storage Flux oven @ 250°F,	
COOLING SHOES	Size/Type: 24" Long/Copper; Flow: N/R; Max Temp: 165°F	FINAL VISUAL: X Satisfactory ___ Visual Defects; Description: Good Appearance	FINAL RT: ___ Satisfactory; N/A Unsatisfactory; Procedure	

Joint Design & Details



$R.O._t = 1\text{-}1/2" \; {}^{+1/16"}_{-0}$

$R.O._b = 1\text{-}3/8" \; {}^{+1/16}_{-0}$

GUIDE TUBE SPACING 6"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION: DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	155 ipm	45 V	1-1/2 in.	350-400 A	4 sec.	12 sec.	5 cpm	N/R	Joint was restarted after 1 misfire. 7 mins. to start.
RUNNING	225 ipm	55 V	—	525 A	↓	↓	↓	↓	Deposition rate = 85#/hı

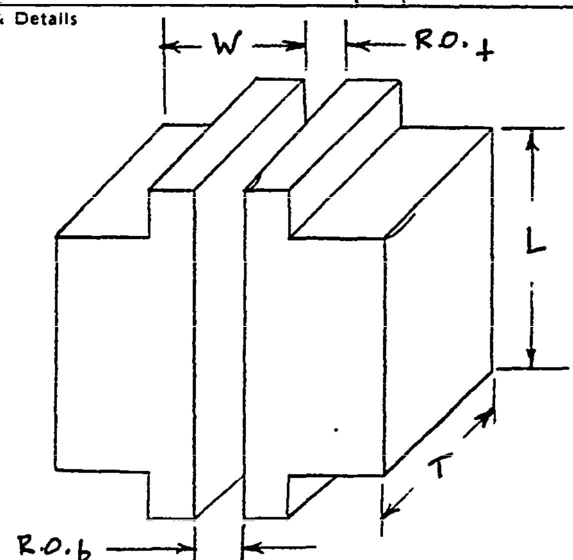
Technicians/SSN	Charge	Date	Joint No.
Byrd/Meckley	1026M-9	6/19/85	M685-29

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting
Preheat (min) 150°F	method Torch Tempstick	measured by ---	PREHEAT SUMP AREA ONLY; Interpass N/A
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator	
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018	1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 24"L x 12"W x 19"T; PO/Heat/Lot: N/R; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59; 5/8" Inside Diameter	FLUX: Brand/Type Linde 124 & PF-2; Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type: 24" Long/Copper; Flow: N/R; Max Temp: 150°F	FINAL VISUAL: X Satisfactory ___ Visual Defects; Description	FINAL RT: ___ Satisfactory ___ Unsatisfactory N/A; Procedure

Joint Design & Details



$R.O._t = 1\text{-}1/2" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}3/8" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING ~~4 11/16"~~

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	OSCILLATION CYCLE TIME	OSCILLATION FREQUENCY	OSCILLATION AMPLITUDE	
START	150 ipm	55 V	1-1/2 in.	325-350 A	4 sec.	12 sec.	5 cpm	N/R	4 1/2 mins. to start
RUNNING	175 ipm	55 V	—	450-500 A	↓	↓	↓	↓	Final Slag Depth = 1-1/ Deposition Rate = 76#/h

Technicians/SSN	Charge	Date	Joint No.
Byrd/Meckley	1026M-9	6/26/85	M685-30

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS: 2 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING

POSITION: VERTICAL UP

___ plate
X casting

Preheat (min): 150°F
method: Torch
measured by: Tempstick
PREHEAT SUMP AREA ONLY
Interpass: N/A

EQUIPMENT
Power Supply: Hobart RC-1000
Polarity: DCEP
Wire Feeder: Hobart

CONTROLS:
Hobart Multi-Torch Control Box
Hobart Multi-Wire Oscillator

FILLER MAT'L
Size/Type: 3/32" Dia./Cored Wire
Brand: Hobart PS-588
Specification: EWT2 (AWS 5.25-78)

5/8" Dia. Guide Tubes
Hobart Type No. 58
ASTM A108 Gr. 1018

1/4" Dia. Round Bar
Commercial
ASTM A108 Gr. 1018

BASE MAT'L
Dimensions: 24"L x 12"W x 8"T
PO/Heat/Lot: N/R
Specification: MIL-S-15083 Gr. B

INSULATOR:
Hobart Type No. 59
5/8" Inside Diameter

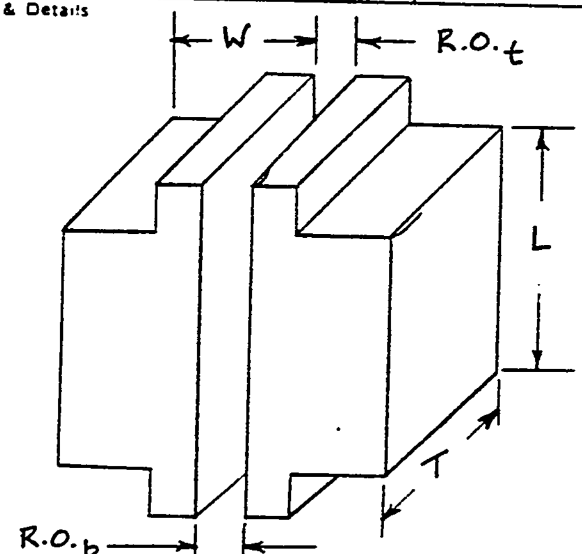
FLUX
Brand/Type: Linde 124 Only
Storage: Flux oven @ 250°F, Remained warm to touch

COOLING SHOES
Size/Type: 24" Long/Copper
Flow: N/R
Max Temp: 160°F

FINAL VISUAL
___ Satisfactory X Visual Defects
Description: Small LOF on one side-repaired w/7018

FINAL RT
___ Satisfactory
___ Unsatisfactory N/A
Procedure

Joint Design & Details



$R.O._t = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}1/4" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

GUIDE TUBE SPACING 4"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	175 ipm	45 V	1-1/2 in.	400-450 A	3 sec.	10 sec.	6 cpm	N/R	Good start. Color not as red as with Hobart flux.
RUNNING	175 ipm	55 V	—	400-450 A	↓	↓	↓	↓	Deposition rate = 36 #/hr Normalized @ 1600°F for 11 hours

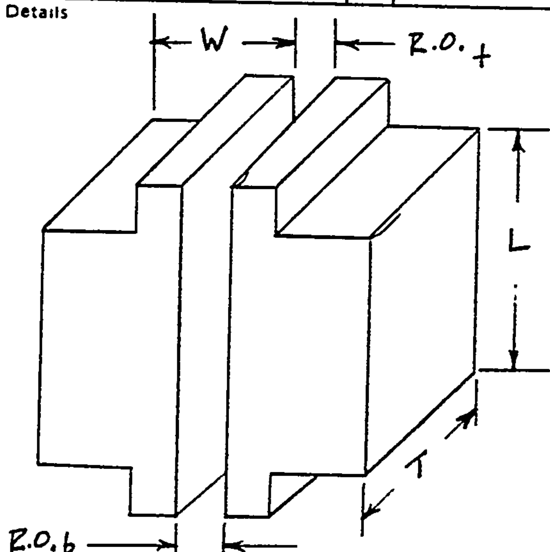
Technicians/SSN: Byrd/Meckley
Charge: 1026M-9
Date: 7/11/85
Joint No: M685-33

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting	Preheat (min) 150°F; method Torch; measured by Tempstick; PREHEAT SUMP AREA ONLY; Interpass N/A
EQUIP-MENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator		
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018	1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018	
BASE MAT'L	Dimensions: 24"L x 12"W x 16"T; PO/Heat/Lot: N/R; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59; 5/8" Inside Diameter	FLUX: Brand/Type: Linde 124 & PF-20; Storage: Flux oven @ 250°F, Remained warm to touch	
TOOLING SHOES	Size/Type: 24" Long/Copper; Flow: N/R; Max Temp: 165°F	FINAL VISUAL: X Satisfactory ___ Visual Defects; Description	FINAL RT: ___ Satisfactory; ___ Unsatisfactory N/A; Procedure	

Joint Design & Details



$R.O._t = 1\text{-}1/2" \begin{smallmatrix}+1/16"\\-0\end{smallmatrix}$

$R.O._b = 1\text{-}3/8" \begin{smallmatrix}+1/16\\-0\end{smallmatrix}$

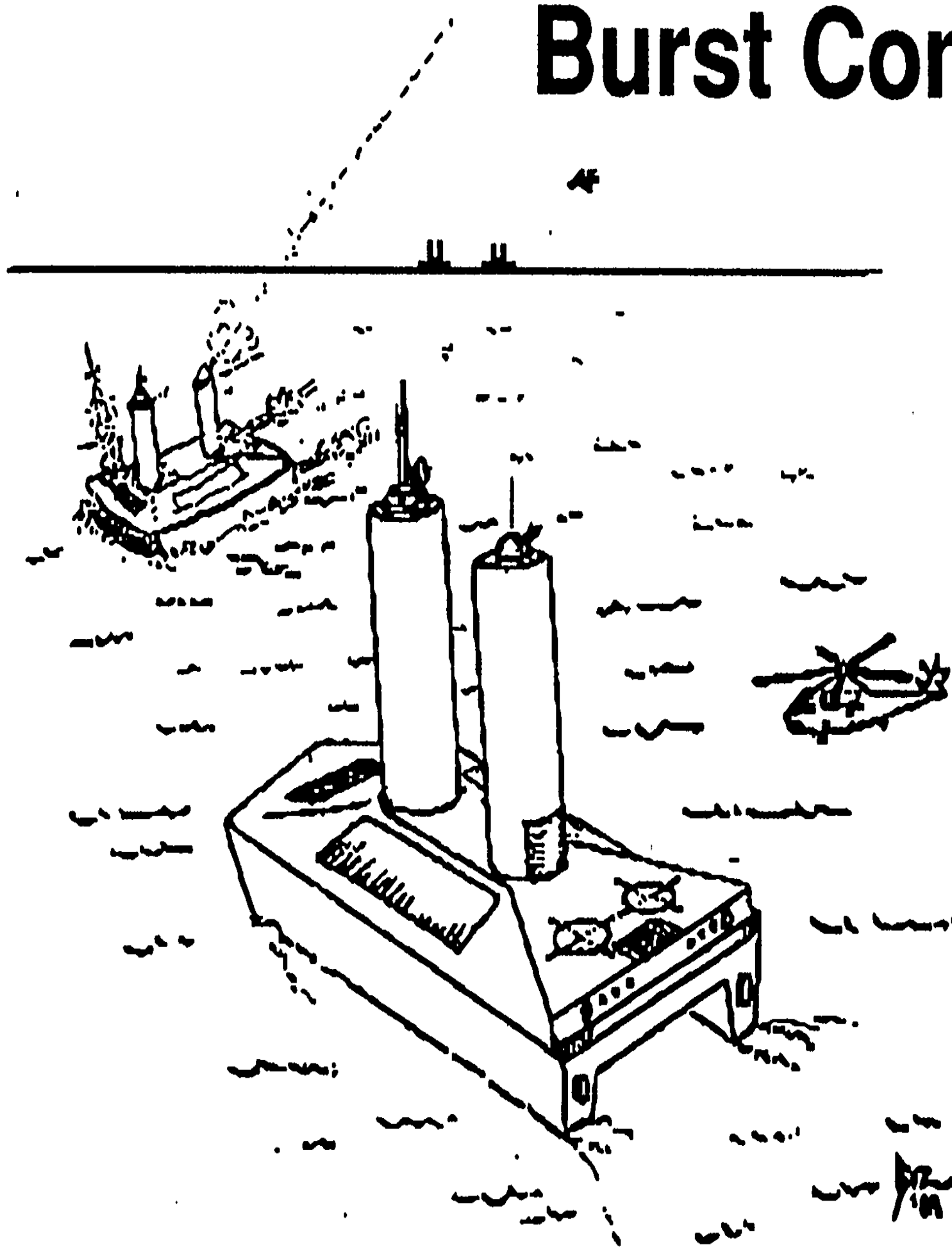
GUIDE TUBE SPACING ~~3-7/8"~~

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	165 ipm	55 V	1-1/2 in.	400 A	3.5 sec.	11.5 sec.	N/R	1-11/16	5 mins. to start
...ING	↓	↓	—	↓	↓	↓	↓	↓	Deposition rate = 74 #/hr.

Technicians/SSN	Charge	Date	Joint No.
Byrd/Meckley	1026M-9	7/27/85	M685-35

David Taylor Research Center

Low Energy Maintena
Burst Combat For



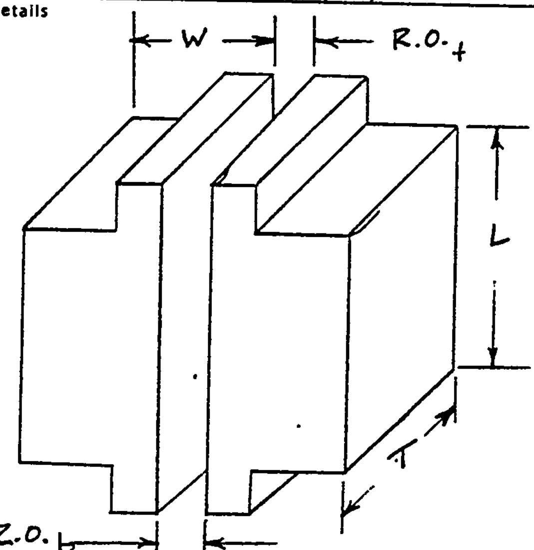
A Force thi
peacetim
wind or s
for its en
requirem
wartime,
power de
power pl
provides
power for
speed pr
and for w
utilizatio

ELECTROSLAG DATA SHEET

Newport News Shipbuilding
A Tenneco Company

PROCESS	4 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate X casting	Preheat (min) 150°F method Torch measured by Tempstick
EQUIP-MENT	Power Supply: Hobart RC-1000 Polarity: DCEP Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box Hobart Multi-Wire Oscillator		PREHEAT SUMP AREA ONLY Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Solid Wire Brand: Hobart 25-P Specification	5/8" Dia. Guide Tubes Hobart Type No. 58 ASTM A108 Gr. 1018		1/4" Dia. Round Bar Commercial ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 24"L x 12"W x 24"T PO/Heat/Lot: N/R Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59 5/8" Inside Diameter		FLUX: Brand/Type Linde 124 & PF-20 Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type: 24" Long/Copper Flow: N/R Max Temp: 175°F	FINAL VISUAL: X Satisfactory ___ Visual Defects Description		FINAL RT: ___ Satisfactory ___ Unsatisfactory N/A Procedure

Joint Design & Details



$R.O._t = 1\text{-}1/2" \ {}^{+}_{-}\ {}^{1/16"}_{0}$

$R.O._b = 1\text{-}3/8" \ {}^{+}_{-}\ {}^{1/16"}_{0}$

GUIDE TUBE SPACING 6"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	N/R	N/R	1-1/2 in.	N/R	4 sec.	12 sec.	5 cpm	N/R	Same start settings as -37. Power supply blew a fuse during start. Joint was restarted, after cleaning out the old slag.
RUNNING	225 ipm	55 V	—	500-525 A	↓	↓	↓	↓	

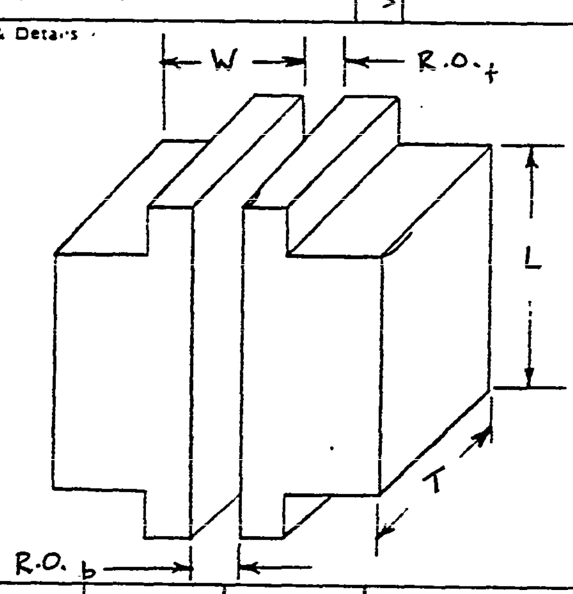
Technicians/SSN	Charge	Date	Joint No.
Byrd/Meckley	1026M-15	8/8/85	M685-38

ELECTROSLAG DATA SHEET

Newport News Shipbuilding

PROCESS	2 WIRE CONSUMABLE GUIDE ELECTROSLAG WELDING	POSITION: VERTICAL UP	___ plate; X casting	Preheat (min) 200°F; method Torch; measured by Tempstick
EQUIPMENT	Power Supply: Hobart RC-1000; Polarity: DCEP; Wire Feeder: Hobart	CONTROLS: Hobart Multi-Torch Control Box; Hobart Multi-Wire Oscillator		PREHEAT SUMP AREA ONLY; Interpass N/A
FILLER MAT'L	Size/Type: 3/32" Dia./Cored Wire; Brand: Hobart PS-588; Specification: EWT2 (AWS 5.25-78)	5/8" Dia. Guide Tubes; Hobart Type No. 58; ASTM A108 Gr. 1018		1/4" Dia. Round Bar; Commercial; ASTM A108 Gr. 1018
BASE MAT'L	Dimensions: 24"L x 12"W x 8"T; PO/Heat/Lot:; Specification: MIL-S-15083 Gr. B	INSULATOR: Hobart Type No. 59; 5/8" Inside Diameter		FLUX: Brand/Type PF-203 Only; Storage Flux oven @ 250°F, Remained warm to touch
COOLING SHOES	Size/Type: 24" Long/Copper; Flow: N/R; Max Temp: N/R	FINAL VISUAL: X Satisfactory ___ Visual Defects; Description		FINAL RT: ___ Satisfactory ___ Unsatisfactory N/A; Procedure

Joint Design & Details



$R.O._t = 1\text{-}1/4" {+1/16" \atop -0}$

$R.O._b = 1\text{-}1/8" {+1/16 \atop -0}$

GUIDE TUBE SPACING 4"

	WIRE FEED SPEED	VOLTS	ELECTRODE EXTENSION	AMPERAGE PER WIRE	OSCILLATION DWELL	CYCLE TIME	FREQUENCY	AMPLITUDE	
START	175 ipm	45 V	1-1/2 in.	400-450 A	3 sec.	10 sec.	6 cpm	N/R	Good start
RUNNING	175 ipm	55 V	—	400-450 A	↓	↓	↓	↓	Deposition rate = 34#/h Normalized @ 1600°F for 11 hrs.

Technicians/SSN	Charge	Date	Joint No.
Meckley/Byrd	1026M-9	7/5/85	M685-32

APPENDIX E

PROCEDURE QUALIFICATION OF ESW FOR SHAFT STRUTS

Purpose:

This qualification provides supporting data for a procedure to weld thick carbon steel castings using the electroslag-consumable guide welding process.

Process Description:

Electroslag-consumable guide welding (ESW) is a single pass process performed in the vertical position. Current is passed through one or more electrodes into a bath of molten slag. The resistivity of the slag maintains a molten bath and melts the electrode as it exits from the consumable guide. The consumable guide and the base metal are also melted BY the slag bath. Shielding from the atmosphere is accomplished by the molten slag. A diagram of the process is shown in figure 1. A sump or run-off tab is placed at the top and bottom of the joint. The bottom sump allows the process to stabilize and insure fusion. The top sump allows molten flux and molten metal to extend beyond the joint so joint fill is obtained. " Water cooled copper shoes are placed along the joint sides for the full length of the joint. This contains the molten flux and weld metal in the joint and gives the contour to the weld bead faces.

Discussion:

Two carbon steel castings were joined using multi-consumable guide ESW. Three consumable guides were connected by 1/4" diametar carbon steel round bar. The ends of the outside guides were cut at a 45 angle to protect the electrode openings from spatter at the start (figure 2). Insulators, composed of a material similar to the flux, were used to protect the consumable guides from making contact with the side walls. Parameters used to produce the weld are recorded in Technique Sheet 1.

After welding, the test assembly was annealed The assembly was heated to 1600 F, soaked for 11 hours, oven cooled to 500 F, then air cooled.

Nondestructive testing was done in accordance with Military Standard 271D. Magnetic Particle testing met the requirements of NavShips 0900-003-8000. Radiographic testing met the requirements of NavShips 0900-003-9000 Class 1.

Destructive testing was performed in accordance with and met the requirements of Military Standard 248B. A curve of charpy impact values for the weld metal and the base material are being submitted for information (figure 3). Results of the destructive testing are recorded in Table 1.

TECHNICAL REPORT

NEWPORT NEWS SHIPBUILDING AND DRY DOCK CO.
NEWPORT NEWS, VIRGINIA

INDEX FILE PAGE 746
NN FORM 198-12

REPORT NO.	RESEARCH INDEX NO.	CHARGE NO.
S01.10A-2		G2004-2404

AUTHOR	DEPT.
M.J. Rice	037

TITLE

Procedure Qualification for Electroslag (Consumable Guide) Welding (ESW) of Carbon Steel Castings

SECURITY CLASSIFICATION	NO. OF PAGES	DATE
Unclassified	6	4-8-83

KEY WORDS
C/S
ESW
Multi-guide
10 3/4"
PWHT

ABSTRACT

Two 10 3/4" thick carbon steel castings were welded using the electroslag (multi-consumable guide) welding (ESW) process. The finished weld was annealed prior to nondestructive testing.

The completed weld satisfactorily met the requirements of Military Standard 00248B (Ships), "Welding and Brazing Procedure and Performance Qualification". Welding parameters for performing the subject weld and mechanical test results have been recorded herein.

DISTRIBUTION:

REQUESTER:

COPIES TO: 1 - Engineering Research Dept., 033
1 - 037 File

APPROVED BY B.C. Howser 5-5-83
915

NONDESTRUCTIVE TESTING

☒	technique	acceptance	sat	unsat
MT	Mil-Std-271D	0900-003-8000	X	
RT	Mil-Std-271D	0900-003-9000	X	

DROP WEIGHT TEST

#	°F	Brk	No Brk	#	°F	Brk	No Brk

GUIDED BEND TEST

R= 9/16"	dimensions= 3/8" x 1 3/4"				
#	sat	unsat	#	sat	unsat
1A→1E	X				
2A→2E	X				
3A→3E	X				
4A→4E	X				

S-side F-face R-root

TENSILE TEST

#	dimensions Wid.	Thick	in²	load lbs.	tensile psi	* 1
1A	1.000	1.394	1.394	100100	71807	B
2A	1.005	1.395	1.401	101500	72448	B
1B	1.000	1.395	1.395	100300	71899	B
2B	1.003	1.396	1.400	101300	72357	B
1C	1.000	1.393	1.393	100800	72361	B
2C	1.003	1.395	1.399	100800	72051	B
1D	1.002	1.393	1.395	97300	69749	B
2D	.996	1.393	1.387	99700	71881	B
1E	1.005	1.395	1.401	102200	72947	B
2E	.997	1.395	1.390	100300	72158	B

*1-location of failure:W-weld;F-fusion line;B-base metal.

DEPOSIT ANALYSIS

MACRO TEST

# of spec	sat	unsat

INTERGRANULAR CORROSION TEST

method	sat	unsat

DELTA FERRITE

method	%	FN

TOUGHNESS TEST
(For Information)

#	loc.	ty.	°F	ft/p	lateral exp mils	%	%shear
1	Weld	V	-20	5			
2	↓	↓	↓	5			
3				5			
4				4			
5				6			
6				4			
7				4			
8				5			
9				5			
10				5			
11				4			
12				5			
13				5			
14				4			
15				5			

Table 1 Destructive and Non-destructive Test Results

Laboratory Services Test Report Number: 562-W

W.E. Test Report No. SO1.10A-2

M. J. Rice

Welding Engineering

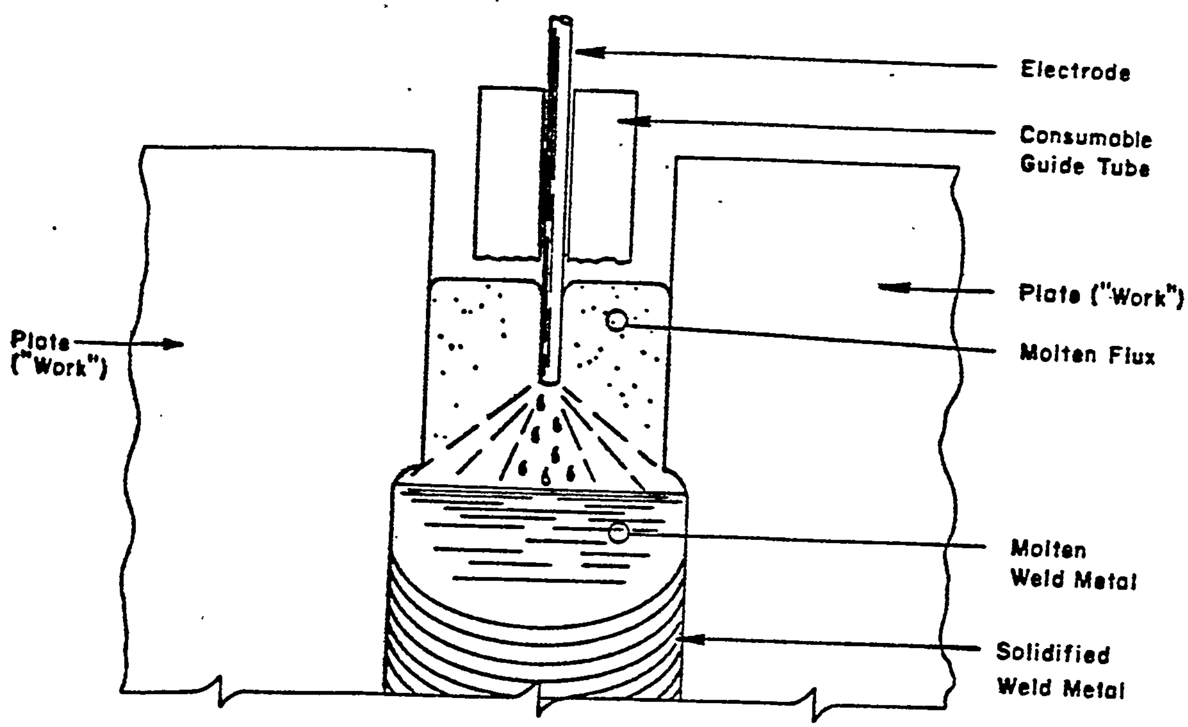


Figure 1 Electroslag Welding Process

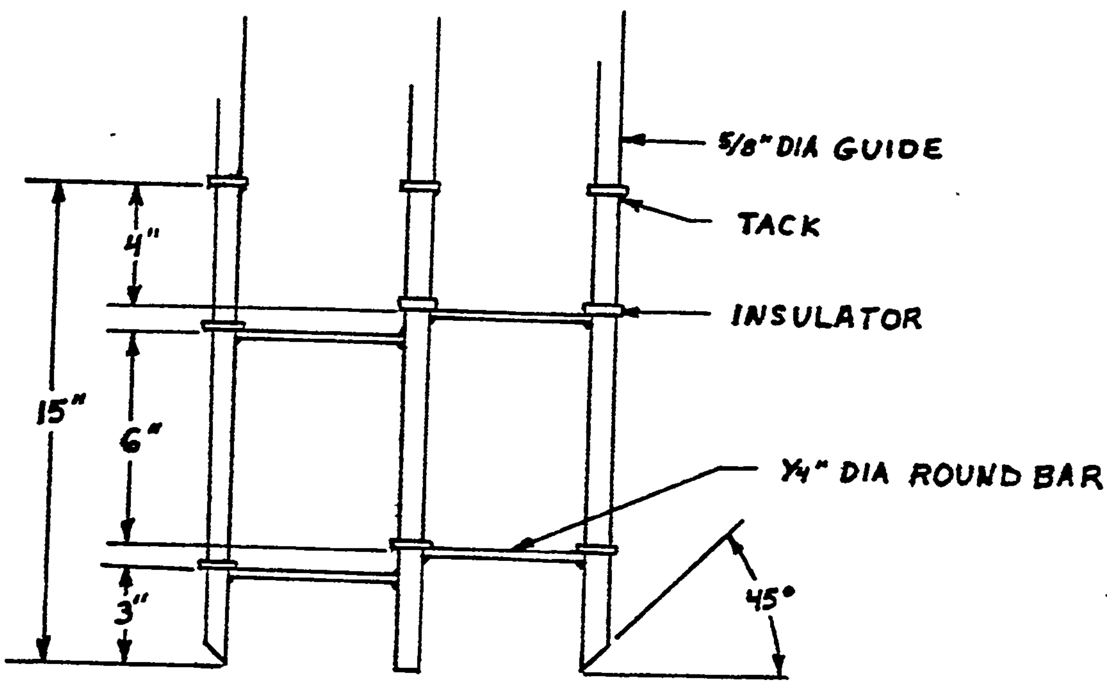
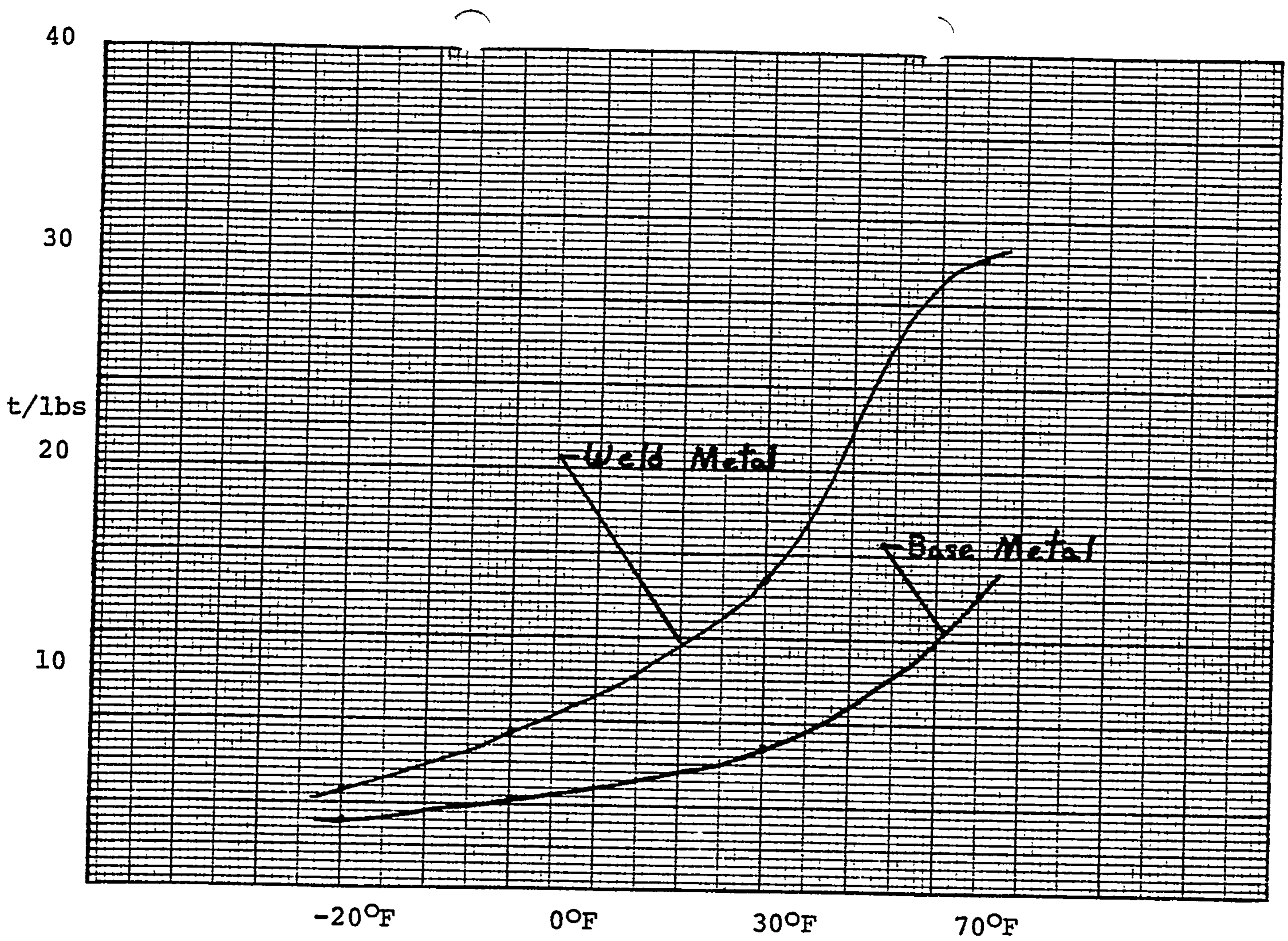


Figure 2 Consumable Guide Arrangement

W.E. Test Report No. S01.10A-2



Test Temp	-20°F	0°F	30°F	70°F
• Base	3	4	5	14
	3	4	6	15
	3	5	6	14
	4	4	6	16
	3	4	9	12
Avg	3.2	4.2	6.4	14.2
• Weld	5	8	14	32
	4	8	15	34
	5	7	12	33
	5	8	13	36
	5	7	18	22
Avg	4.8	7.6	14.4	31.4

Figure 3 Base and Weld Metal Charpy Curve

W.E. Test Report No. S01.10A-2